

$$T_{CCL} = 2 \text{ ft} = 0.6 \text{ m}$$

then F_w from Eqs 3 equals 0.3, which means that there would be less water percolation through the GCL than a compacted clay liner – equivalency is established for these conditions.

Alternatively, one can assume that water flux through the GCL is equal to the water flux through a CCL (i.e., $F_w = 1$):

$$V_{GCL} = V_{CCL} \quad (4)$$

and compute the required hydraulic conductivity of the GCL by substitution in Eq. 4:

$$k_{GCL} \frac{H + T_{GCL}}{T_{GCL}} = k_{CCL} \frac{H + T_{CCL}}{T_{CCL}} \quad (5)$$

to obtain:

$$(k_{GCL})_{Required} = k_{CCL} \frac{T_{GCL}}{T_{CCL}} \frac{H + T_{CCL}}{H + T_{GCL}} \quad (6)$$

Equation 6 may be used to determine the hydraulic conductivity of the GCL necessary to establish equivalency. So long as the job specifications require that the actual hydraulic conductivity be less than the value computed from Eq. 6, equivalency in terms of steady water flux is theoretically guaranteed. The required hydraulic conductivity of the compacted clay liner (k_{CCL}) is almost universally established as 1×10^{-7} cm/s by regulatory agencies in the U.S. The thickness of GCLs (T_{GCL}) varies from product to product, but is typically about 7 mm after hydration at low overburden stress. The head of liquid on the barrier layer is expected to be low in a final cover system; evapotranspiration and the nature of rainfall events makes the buildup of head on the barrier layer much less likely in final covers than in landfill liners. For illustrative purposes, three values of head of water (H) on the CCL or GCL are assumed: 0, 1 inch, and 1 foot. The required hydraulic conductivity of the GCL for equivalent performance to a compacted clay liner in terms of steady flux of water through the liner is computed as follows:

For a 1-ft-thick compacted clay liner:

- $(k_{GCL})_{Required} = 1 \times 10^{-7}$ cm/s for a negligibly small head of water on the liner
- $(k_{GCL})_{Required} = 2 \times 10^{-8}$ cm/s for a water head of 1 inch on the liner
- $(k_{GCL})_{Required} = 4 \times 10^{-9}$ cm/s for a water head of 12 inches on the liner

For a 2-ft-thick compacted clay liner:

- $(k_{GCL})_{Required} = 1 \times 10^{-7}$ cm/s for a negligibly small head of water on the liner
- $(k_{GCL})_{Required} = 2 \times 10^{-8}$ cm/s for a water head of 1 inch on the liner
- $(k_{GCL})_{Required} = 3 \times 10^{-9}$ cm/s for a water head of 12 inches on the liner

As discussed earlier, the hydraulic conductivity of the bentonite component of commercially-produced GCLs is typically ≤ 1 to 5×10^{-9} cm/s. Thus, it is clear that equivalency

of a GCL to a CCL, in terms of the amount of water that passes through a GCL under conditions of steady seepage, can be established for most, if not all, landfill covers.

A GCL can also be used in conjunction with a layer of compacted soil as shown in Fig. 4d. In such cases, the compacted soil will tend to be thinner or be of higher hydraulic conductivity compared to the minimum requirements for compacted clay liners usually established by regulatory agencies. If the compacted soil liner were neither thinner nor more permeable than required by regulation, there would be no motivation to use a GCL, other than to provide redundancy.

By employing a GCL and a compacted soil liner (CSL) of hydraulic conductivity k_{CSL} , which is greater than the usual requirement for a compacted clay liner, one may be able to achieve an acceptable alternative to a conventional compacted clay liner. The equivalent hydraulic conductivity (k_{eq}) of the composite GCL-CSL may be computed from the following equation:

$$k_{eq} = \frac{T_{GCL} + T_{CSL}}{\frac{T_{GCL}}{k_{GCL}} + \frac{T_{CSL}}{k_{CSL}}} \quad (7)$$

For example, if compacted soil liner has $k_{CSL} = 1 \times 10^{-6}$ cm/s and $T_{CSL} = 1$ ft, and the GCL is 7-mm-thick with a hydraulic conductivity of 1×10^{-9} cm/s, then the equivalent hydraulic conductivity (k_{eq}) of the 1.02-ft-thick GCL/CSL liner is 3×10^{-8} cm/s. The idea of combining GCLs with native soils is very appealing not only based on theoretical considerations but also because of the redundancy that the combination provides and the fact that a relatively low-permeability, native soil material is backing up the GCL. The situation depicted in Figure 4d and described in this paragraph is presented primarily to illustrate the options available to the designer in trying to meet regulatory agency concerns and yet use non-standard materials or designs.

A composite liner consists of a geomembrane placed in contact with a low-permeability soil. A geomembrane/GCL composite may be considered as an alternate to a geomembrane/CCL composite. If so, flow through the composite should be analyzed. The rate of flow through a flaw in a geomembrane in a composite liner depends on the size of the flaw, the hydraulic conductivity of the underlying clay component, the hydraulic gradient across the clay component, the hydraulic contact between the geomembrane and the clay component, and the presence of a geomembrane within the GCL. No equations have been published for explicit purpose of computing flow rates through a defect in a geomembrane component of a geomembrane/GCL composite liner. The presence of a geotextile between the geomembrane and bentonite may influence overall performance. This is a topic of current research. However, it is likely that equivalency can be demonstrated with reasonable assurance for some or all GCLs that are used with geomembranes to form composite liners.

2. Time to Initiate Discharge of Water from Base of Liner ("Breakout Time")

Geosynthetic clay liners and compacted clay liners are initially unsaturated with water. Geosynthetic clay liners contain essentially dry bentonite, but compacted clay liners are often very close to saturation at the time of construction. When liquid first enters the upper surface of an unsaturated liner, no liquid discharges from the base of the liner until the liner absorbs enough water to reach field capacity at the base.

A GCL might be compared to a CCL in terms of time to discharge of water from the bottom of the liner on the assumption that leachate production would not begin until water is

discharged from the base of the barrier layer. However, many people would consider the "breakout time" of water from the barrier layer to be essentially irrelevant because over the long term, the time to initiate discharge of water from the barrier layer is not important. Over the long term, the flux of water through the barrier layer (which controls the amount of leachate produced) is the important issue. As stated earlier, a liner with a hydraulic conductivity of 1×10^{-9} cm/s allows only about 0.01 inch of water to percolate through it per year under continuous exposure to a water source and unit hydraulic gradient. Again, for those GCLs that contain a geomembrane, the presence of the geomembrane should be taken into account in evaluation of breakout time.

The time to discharge water from the base of the liner is difficult to analyze in a simple way. For CCLs, the time depends greatly upon the hydraulic conductivity, initial water content, tendency to swell, and rate of water infiltration into the top of the liner. For GCLs, the time to initiate discharge of water from the base is usually fairly short (a few weeks) if the liner is continuously flooded with water or may be extremely long if water is slowly absorbed by the bentonite. For GCLs that contain a geomembrane, the time may be much greater. A comparison of time to initiate discharge of water from the base of the liner would have to be performed on a site and product specific basis.

In general, it is not believed that breakout time should be an important issue in an equivalency assessment. Other factors seem far more important.

3. Production of Consolidation Water

Application of load to a compacted clay liner tends to squeeze water out of the clay. If this were to occur in a cover, the water might eventually become leachate. Dry GCLs have no capacity to produce consolidation water loading upon loading. In general, the GCL should be viewed as superior to a CCL in terms of minimizing production of consolidation water. However, because the applied loads in final covers are so small, the entire issue of production of consolidation water is usually moot for final covers. This issue is far more important for clay liners located above leak detection layers in bottom liner systems for landfills.

4. Air Permeability

The permeability of a barrier layer to gas may be very important if the barrier layer is expected to restrict the movement of gas through the cover. For porous materials, the air permeability is extremely sensitive to the water content of the soil. Dry materials are highly permeable to air, but water-saturated porous materials are practically impermeable to air.

Compacted clay liners are compacted at a water content that is wet of optimum. Any air present in the CCL tends to be present as isolated bubbles and not in continuous channels. Thus, the air permeability of CCLs tends to be very low. The air permeability of GCLs depends greatly on whether or not a geomembrane is present and how much moisture has been absorbed by the bentonite. The air permeability is high for dry bentonite that is sandwiched between two geotextiles. For GCLs that contain a geomembrane, the geomembrane dominates the material's air permeability and gives it a very low permeability to air. Equivalency in terms of air permeability probably can be demonstrated for GCLs that contain a geomembrane or for GCLs that are sufficiently hydrated to attain a low permeability to air. The bentonite in the GCL can be forced to hydrate quickly either by placing the GCL in contact with a moist soil or by applying water to the overlying soil after the GCL is placed and covered. Laboratory tests indicate that absorption of water by the bentonite occurs within a few weeks (Daniel et al., 1993) -- the hydration of the bentonite can be forced to occur if air permeability is a critical issue.

Physical/Mechanical Issues

The physical/mechanical issues that might be considered in an equivalency analysis include freeze/thaw effects, wet/dry effects, response to total settlement, response to differential settlement, stability on slopes, vulnerability to erosion, and bearing capacity.

1. Freeze/Thaw Resistance

Compacted clay liners are known to be vulnerable to large increases in hydraulic conductivity from freeze/thaw (e.g., Kim and Daniel, 1992, and the references therein), although compacted soil-bentonite mixtures may not be as vulnerable to damage. As discussed earlier, limited laboratory data indicate that GCLs do not undergo increases in hydraulic conductivity as a result of freeze/thaw. Thus, from the available data, GCLs appear to be superior to CCLs in terms of freeze/thaw resistance.

2. Wet/Dry Effects

Wetting and drying of CCLs and GCLs can cause either type of clay liner to swell or shrink. The main concern with clay liners is that desiccation can lead to cracking and to an increase in hydraulic conductivity.

As discussed earlier, available laboratory data indicate that desiccation of wet GCLs does cause cracking, but rehydration of the GCL causes the bentonite to swell and the material to self heal. Thus, GCLs appear to be superior to CCLs in terms of ability to self-heal if the material is wetted, dried, and then rewetted.

3. Response to Total Settlement

Total settlement refers to block-like settlement without significant bending or distortion. It is believed that GCLs and CCLs would both respond similarly to total settlement and that neither would be damaged if there is no bending or distortion.

4. Response to Differential Settlement

LaGatta (1992) studied the effects of differential settlement on the hydraulic conductivity of GCLs. LaGatta placed a water-filled bladder in a "false bottom" located beneath the GCL. The GCL was placed over the bladder and was then covered with 2 ft of gravel to simulate cover material. The GCL was flooded with 1 ft of water, and water draining out the bottom of the experimental apparatus was collected for 2 to 4 months, until the flow rate became steady. Then the bladder was incrementally deflated to produce differential settlement. Boardman (1993) performed similar tests but subjected dry (rather than hydrated) GCLs to differential settlement; the GCLs were hydrated and permeated after the distortion took place in the dry material. The extreme differential settlement caused by the deflated bladders did not produce large increases in hydraulic conductivity for most of the GCLs tested.

Distortion is defined as the differential settlement, Δ , divided by the horizontal distance over which that settlement occurs, L , as shown in Fig. 8. Distortion produces tension, which can lead to cracking. It appears from LaGatta's and Boardman's tests that many GCLs can withstand large distortion (Δ/L up to 0.5) and tensile strain (up to 10 to 15%) without undergoing significant increases in hydraulic conductivity. This finding is in sharp contrast to the results for compacted clay, which are summarized in Table 3 compiled by LaGatta (1992). Normal compacted clay materials cannot withstand tensile strains greater than approximately 0.85% without failing (cracking). Pure bentonite, on the other hand, is reported to have a tensile strain at failure of 3.4%, but LaGatta measured much greater tensile strains without cracking in many

GCLs, probably due to the beneficial reinforcing effects from the geotextiles or geomembrane in the GCLs. In any case, the available data indicate that GCLs can withstand much greater tensile deformation than normal compacted soils without cracking, which is a very favorable characteristic for final covers. Geosynthetic clay liners are considered to be superior to compacted clay liners in terms of resistance to damage from differential settlement.

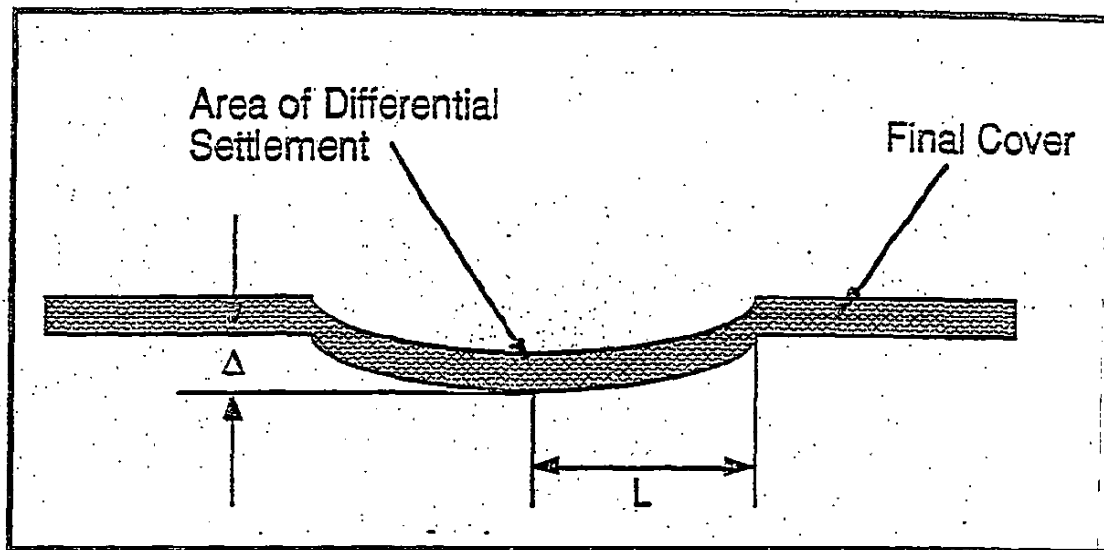


Figure 8. Definition of Distortion (Δ/L).

Table 3. Data on Tensile Strain at Failure for Compacted Clay (from LaGatta, 1992).

Type or Source of Soil	Water Content (%)	Plasticity Index (%)	Failure Tensile Strain
Natural Clayey Soil	19.9	7	0.80%
Bentonite	101	487	3.4%
Illite	31.5	34	0.84%
Kaolinite	37.6	38	0.16%
Portland Dam	16.3	8	0.14%
Rector Creek Dam	19.8	16	0.16%
Woodcrest Dam	10.2	Non-plastic	0.18%
Shell Oil Dam	11.2	Non-plastic	0.07%
Willard Test Embankment	16.4	11	0.20%

5. Stability on Slopes

The shear strength of GCLs is very sensitive to the water content and type of GCL (Shan and Daniel, 1991; and Daniel et al., 1993). Water-saturated GCLs that contain unreinforced, adhesive-bonded bentonite have angles of internal friction for consolidated-drained conditions of approximately 10 degrees. Dry or damp materials are 2 to 3 times as strong as water-saturated GCLs. Also, needle-punched and stitch-bonded GCLs tend to have higher strengths, at least in the short term. The shear strength of CCLs varies widely, depending on materials, water content, and compaction conditions.

In stability analyses, one often must consider not only internal shear failure but interfacial shear with an adjacent layer, e.g., a geomembrane. No general statement can be made about equivalency of a GCL to a CCL in terms of shear strength because the assessment depends on specific materials, the degree to which the bentonite can wet, slope angle, and other site-specific conditions.

6. Vulnerability to Erosion

Erosion resistance may be of concern in final covers if inadequate cover soil is present. With a well-designed and properly maintained cover system, the barrier layer should never be subjected to forces of erosion after the construction phase is over and equivalency should not be an issue. In some cases, however, there may be insufficient cover soil to guarantee that the barrier layer will not be exposed. Because of the presence of erosion-resistant geosynthetic materials in GCLs, most GCLs can potentially be more resistant to erosion than CCLs. However, if the clay liner is exposed to erosive forces, the bentonite may be washed out of some GCL materials. Thus, equivalency depends upon the specific materials being considered. For many sites, erosion will not be of any concern, e.g., for a GCL underlying a geomembrane or a cover with adequate cover soil.

7. Bearing Capacity

A clay liner must have adequate bearing capacity to support loads, e.g., wheel loads from construction or maintenance equipment. The clay liner must not thin or pump clay into adjacent layers under static or dynamic (e.g., traffic) loads.

Hydrated bentonite is not as strong as most materials used in constructing CCLs. However, under most circumstances, both a GCL and a CCL will provide adequate foundation bearing capacity, particularly if the GCL or CCL is buried under sufficient soil overburden. Equivalency is heavily dependent upon site-specific conditions.

Construction Issues

The construction issues that might be considered in an equivalency analysis include puncture resistance, effect of subgrade condition on constructability, ease of placement, speed of construction, availability of materials, requirements for water, air pollution effects, weather constraints, and quality assurance requirements.

1. Puncture Resistance

Geosynthetic clay liners are thin and, like all thin liner materials, are vulnerable to damage from accidental puncture during or after construction. Thick CCLs cannot be accidentally punctured. Some GCLs have the capability to self-seal around certain punctures, e.g., penetration of the GCL with a sharp object such as a nail. The swelling capacity of bentonite gives GCLs this self-healing capability. Of greater concern than penetration of the

GCL by an object after construction is accidental puncture during construction. For example, if the blade of a bulldozer accidentally punctures the GCL during spreading of cover material, the GCL would probably not self seal at the puncture.

The puncture resistance of GCLs will generally not be equivalent to that of CCLs. However, this does not mean that a GCL cannot meet or exceed the performance objectives of a compacted clay liner. Quality assurance and quality control procedures can be established and implemented to make the probability of puncture during construction extremely low. In final covers, one or two accidental punctures would probably not have a major impact on the overall performance of the barrier layer. In a bottom liner system subjected to a continuous head of liquid, a different conclusion might be drawn about the significance of undetected and unrepaired damage to a GCL from puncture. Ultimately, site-specific conditions and quality assurance procedures will be critical in dealing with the issue of puncture and in establishing equivalency of a GCL to a CCL for a particular project.

2. Effect of Subgrade Condition

Compacted clay liners are constructed with heavy equipment. If the subgrade is compressible (e.g., solid waste), the GCL, which can be installed with lightweight equipment, will be easier to construct. On the other hand, stones and rocks can puncture a GCL but not a CCL; if the subgrade contains stones or rocks, the integrity of the GCL may be compromised. Also, in order for the overlapped seams in a GCL to self seal properly, the overlapped panels must be placed on a reasonably smooth and even subgrade. Thus, equivalency of a GCL to a CCL in terms of the effect of subgrade depends on the condition of the subgrade and will have to be evaluated on a site-specific basis.

3. Ease of Placement or Construction

A GCL will generally be easier to place than a CCL, except under rainy conditions — both GCLs and CCLs are difficult or impossible to construct in heavy rain. In general, GCLs are superior to CCLs in terms of ease of placement or construction.

4. Speed of Construction

Geosynthetic clay liners can be placed much more quickly than CCLs. Geosynthetic clay liners are superior to compacted clay liners in terms of speed of construction.

5. Availability of Materials

Suitable clays for construction of a CCL may or may not be available locally, depending on the site. Because GCLs are a manufactured material, they are readily available and can be shipped to a site quickly. The cost of shipment is usually not a large percentage of the total cost of a GCL. Thus, GCLs will always be at least equivalent to CCLs in terms of availability of materials and will be superior to CCLs at sites lacking local sources of suitable clay.

6. Requirements for Water

Construction water is necessary for many compacted clay soils, which must usually be placed at a moisture content wet of optimum to achieve the desired low hydraulic conductivity. The total amount of water required to moisten a clay liner can be very large. For example, if a 2-ft-thick compacted clay liner were to be constructed over a 10-acre site, and the water content of the soil had to be increased 5% to achieve the required moisture conditions, the total amount of water used would be approximately 600,000 gal. In arid regions, this water may represent a valuable resource, and in some remote locations, it may be very expensive to provide the water.

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Geosynthetic clay liners do not require construction water and are superior to CCLs in this regard.

7. Air Pollution Effects

Air pollution is a subject of great concern in some areas. Construction of compacted clay liners tends to be an energy intensive activity with heavy equipment excavating the soil, hauling the soil, processing the soil, spreading the soil, and compacting the soil with repeated passes of heavy compactors. All of this activity adds to air pollution in terms of hydrocarbon emissions from the equipment and air-borne particulate matter (dust). Geosynthetic clay liners are shipped to the site, moved into position by machinery, and then unrolled (sometimes by hand). Relatively speaking, the impacts to air quality are less with a GCL than a CCL.

8. Weather Constraints

Compacted clay liners are difficult to construct when soils are wet, heavy precipitation is occurring, the weather is extremely dry (clay desiccates), the soil is frozen, or the temperature is below freezing. Geosynthetic clay liners are difficult to construct during precipitation. Weather constraints generally favor GCLs.

Some, if not all, GCLs must be covered before they hydrate. If a geomembrane will be placed over the GCL, the GCL must be covered almost immediately with the geomembrane. Additional weather constraints, e.g., wind speed, may apply to the geomembrane and, indirectly, influence the GCL. The fact that many GCLs must be covered before they are hydrated can be a significant weather constraint for GCLs. However, CCLs have weather constraints, too: CCLs must not be allowed to freeze or desiccate, and wet weather often brings construction of compacted clay liners to a halt. GCLs cannot desiccate during construction because they are dry, and dry GCLs are unaffected by freezing temperatures.

Equivalency in terms of weather constraints must be considered on a site-specific basis, but weather constraints generally favor GCLs over CCLs.

9. Ease of Quality Assurance

The proper construction of a low-permeability, compacted clay liner is a very challenging task. Careful control must exist over materials, moisture conditions, clod size, maximum particle size, surface preparation for a lift of soil, lift thickness, compaction coverage and energy, and protection of each completed lift. Comparatively, quality assurance (QA) requirements are much less extensive for GCLs compared to CCLs, but no less critical. In general, while QA for a compacted clay liner requires a number of relatively sophisticated tests and points of control by very experienced and capable personnel, QA for GCLs is more nearly the application of common sense. Far fewer things can go wrong with the installation of a GCL compared to placement and compaction of a CCL. However, testing procedures and observational techniques are well established for CCLs but are not for GCLs. Many people are working to establish testing methods for GCLs. While it would appear that GCLs are superior to CCLs in terms of ease of quality control, more work needs to be done to establish standard test methods for GCLs.

Summary of Equivalency Issues

Table 4 summarizes the preceding discussion of equivalency. Equivalency can be demonstrated generically in many categories. In several areas, geosynthetic clay liners (GCLs) are clearly superior to compacted clay liners. However, in one category, equivalency probably cannot be demonstrated: thin GCLs do not have the same resistance to puncture as much thicker compacted clay liners. Although thin GCLs can be punctured during construction, careful QA

should be capable of addressing this potential problem. Further, for final covers, an occasional small puncture may be of little consequence. Indeed, puncture is probably of much greater concern for a bottom liner than a final cover. Also, if puncture is of concern, a layer of relatively low permeability soil or waste material may be placed below the GCL to provide a back-up should puncture occur at an isolated location. In any case, the GCL enjoys several important advantages over a compacted clay liner which may more than offset greater vulnerability to puncture.

As suggested by Table 4, many equivalency issues depend on the GCL product and the particular conditions unique to a given site. Equivalency will have to be evaluated on a case-by-case basis. The most important site-specific issues are likely to be permeability to gas and slope stability. It may be difficult to provide adequate factors of safety against slope failure on relatively steeply sloping final covers that contain GCLs, but designers have a variety of reinforcement materials (such as geogrids) available for use, if necessary.

Table 4 - Potential Equivalency Issues.

Category	Criterion for Evaluation	Equivalency of GCL to CCL			
		GCL Is Probably Superior	GCL Is Probably Equivalent	GCL Is Probably Not Equivalent	Equivalency Depends on Site or Product
Hydraulic Issues	Steady Flux of Water		X		
	Breakout Time of Water				X
	Production of Consolidation Water	X			
Physical/ Mechanical Issues	Permeability to Gas				X
	Freeze-Thaw	X			
	Wet-Dry	X			
	Total Settlement		X		
	Differential Settlement	X			
	Slope Stability				X
Construction Issues	Erosion				X
	Bearing Capacity				X
	Puncture Resistance			X	
	Subgrade Condition				X
	Ease of Placement	X			
	Speed of Construction	X			
	Availability of Materials	X			
	Requirements for Water	X			
	Air Pollution Effects	X			
	Weather Constraints				X
	Ease of Quality Assurance	X			

CONCLUSIONS

In this paper the characteristics of geosynthetic clay liners (GCLs) have been described and potential applications of GCLs in final covers for landfills have been discussed. Current regulations typically require that a final cover contain a compacted clay liner (CCL) with a thickness of 1 to 2 ft and a maximum hydraulic conductivity of 1×10^{-7} cm/s. The issue is whether it is sensible to replace all or part of the compacted clay liner with a GCL in final covers at some landfill sites.

There are several advantages of GCLs over CCLs, including better resistance to freeze-thaw, better self healing characteristics in wet-dry conditions, less vulnerability to damage from differential settlement, less consumption of landfill space, easier placement, faster placement, lack of need for local clay materials, less requirement for construction water (relevant for arid areas), and easier quality assurance. Geosynthetic clay liners will probably cost less than compacted clay liners for many, and perhaps most, sites. The major draw-backs of GCLs are greater vulnerability to damage from puncture, concern over shear strength on slopes, high permeability of dry bentonite to landfill gas if the GCL remains dry (e.g., in an extremely arid location), and lack of explicit endorsement of GCLs by regulatory agencies.

A framework has been established in this paper for evaluating whether or not a GCL can meet the same performance objectives as a compacted clay liner used in a landfill cover. Three main criteria were established: hydraulic performance, physical and mechanical performance, and construction issues (including quality assurance). For landfill covers, geosynthetic clay liners can be shown to provide equivalent or superior performance to compacted clay liners in many respects. However, some performance considerations (e.g., slope stability) depend on site and product specific considerations. Thus, no generic conclusion can be reached about equivalency of a GCL to a CCL at all sites — an equivalency assessment is needed on a project-specific basis. It is expected that GCLs can be shown to provide superior or equivalent performance at many landfill sites.

Although GCLs are not without limitations, their favorable properties are sufficiently advantageous that landfill owners, designers, and regulatory officials should give serious consideration to expanded use of GCLs in landfill covers. There is a need to reach agreement about the criteria upon which GCLs will be evaluated, and it is hoped that this paper will help to initiate a dialogue that will ultimately lead to establishment of appropriate criteria.

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Geosynthetics for Advanced Solutions

Performance Evaluation Criteria of GCLs

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Introduction

Overview of GCL industry, products & applications

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Applications & product selection

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Material properties & installation

Leakage rate through GM/GCL composite liners

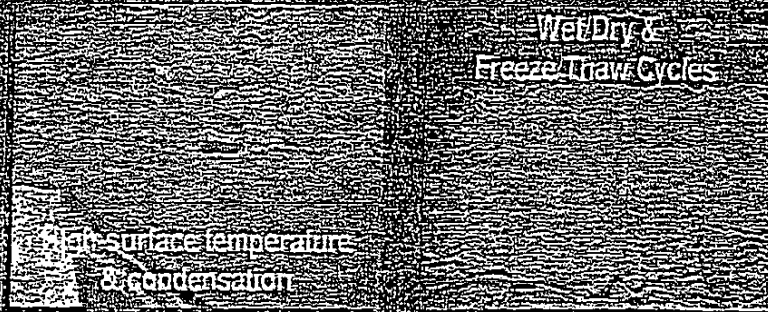
GCL hydration & shear strength

Bentonite compatibility with site liquids & soils

Summary

Geosynthetics for Advanced Solutions

CCL Field Problems



GCLs utilized in waste containment since 1985

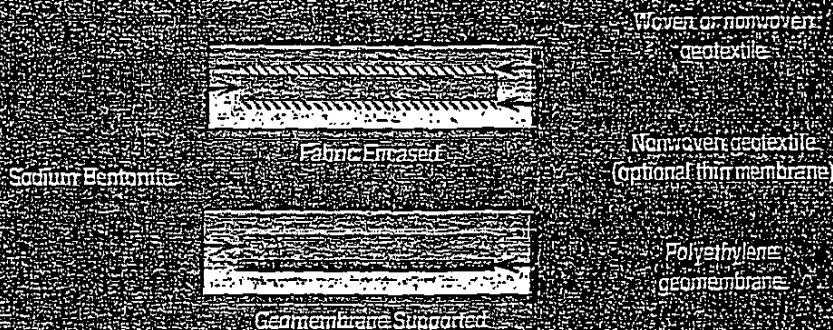
Equivalency criteria of GCLs vs. CCLs (Koerner & Daniel, 1993)

Evaluate on a project by project basis

Commercially Available GCLs

Geosynthetic Clay Liners (GCLs)

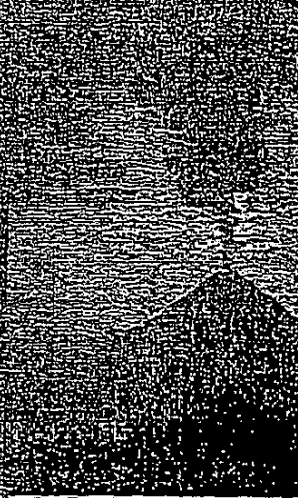
Manufactured hydraulic barriers consisting of bentonite clay bonded to a layer or layers of geomembranes or geotextiles



Geosynthetics for Advanced Solutions

The Key: Sodium Bentonite

- Montmorillonite clay formed from volcanic ash deposits
- Swell up to 15 times its volume
- Permeability of 1×10^{-12} cm/sec
- Susceptible to chemical attack & cation-exchange
- Proper protection promotes long-term performance

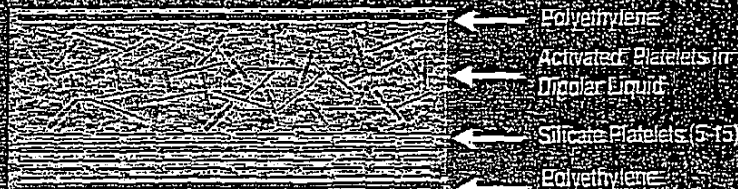


Geomembrane-Supported GCL

- One product composite (geomembrane/clay) liner
- Combines impermeable geomembrane with sealing ability of bentonite
- Improved leakage resistance over bentonite alone

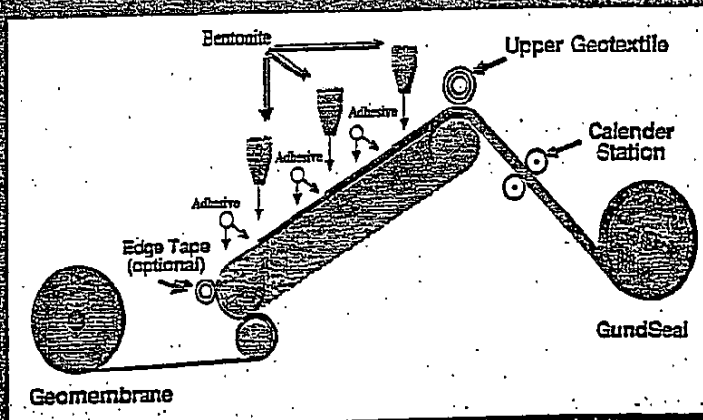


Unique water adsorption between bentonite silicate platelet structure



Geosynthetics for Advanced Solutions

Manufacturing Description



Available GundSeal Product Line

HDPE geomembrane backing

Flat lying applications

Smooth: 1.4-2.0 mm (15-60 mil)

Sloping applications

Textured: 1.4-2.0 mm (30-80 mil)

4.9 kg/m² (1.0 lb/ft²) sodium bentonite

Geotextile attached to bentonite surface

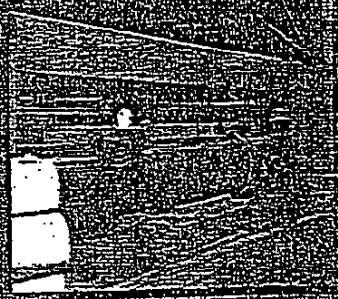
Roll dimensions

Length: 61 m (200 feet) maximum

Width: 2.4 and 5.3 m (8 & 17.5 feet)

Custom rolls available

Optional bentonite free edges for welding



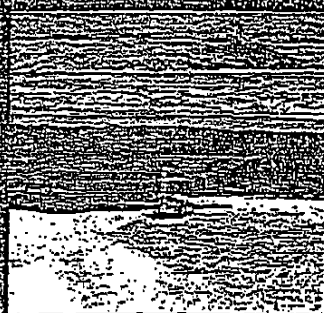
GEOSYNTHETICS FOR ADVANCED SOLUTIONS

GCL Applications

- Replace/augment GCL caps
- Replace CCLs in GM/CCL composite liners/caps
- Replace both GM & CCL as one product GM/CCL

Typical Applications

- Clay caps/closures
- Landfill composite bottom liners & caps
- Surface impoundment liners
- Mining leach pads & impoundments
- Secondary containment
- Waterproofing



Applications: Replace/Augment CCLs

- GeoSeal replace/augment CCL Caps
- Deployed bentonite side down
- Standard geomembrane backings
- Flat/lying projects
 - 15 mil smooth HDPE
- Sloping applications
 - 30 mil textured HDPE



Geosynthetics for Advanced Solutions

Applications: Composite Liner/Cap

GrundSeal installed as a replacement for the CCL

GrundSeal deployed bentonite side up

Separate overlying geomembrane

Encases bentonite between two geomembranes

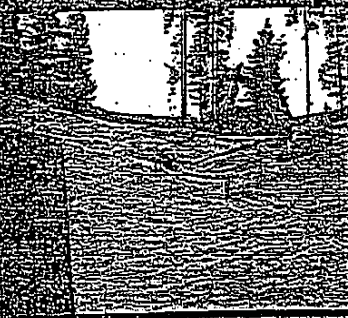
Standard geomembrane backings

Flatting areas: 15 mil smooth

HDPE or VPE

Sloping projects: 30 mil textured

HDPE or VPE



Applications: Landfill Cell Expansion

Terrestrial disputes resolved by added value of the project

Expanding food source

Improved temporary night accommodations (black liner = heat)

Recreational value (i.e. HDPE slope surfing) resulting in minor repairs

Peaceful coexistence with neighbors

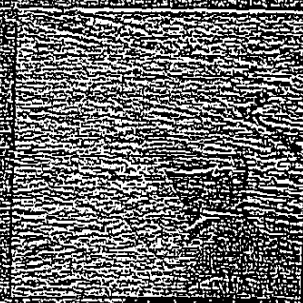
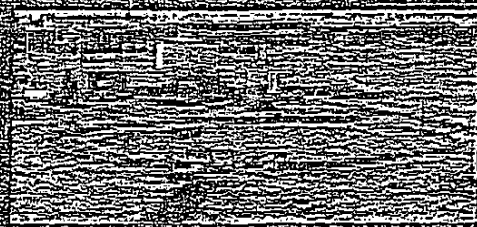


GEOSYNTHETICS FOR ADVANCED SOLUTIONS

Applications: Composite Liner/Cap

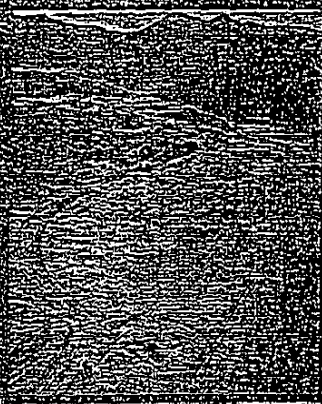
One-product composite (geomembrane/clay) liner

- Barrier design includes GM/GCL
- Manufactured with specified GM
- Installed geomembrane side up
- Bentonite & GM replace design components
- Option of welding the GM seams



Performance Evaluation Criteria

- Material properties testing and installation
- Leakage through GM/GCL
- Slope stability
- Compatibility with liquids & soils



Geosynthetics for Advanced Solutions

GCL Material Specifications & Testing

Bentonite

ASTM D 5890: free swell

ASTM D 5891: fluid loss

Finished Product

ASTM D 5993: mass/area

ASTM D 5887: index flux

ASTM D 6243: direct shear

may not be applicable for
geomembrane GCLs

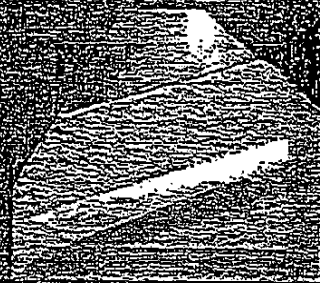
Carrier Geomembrane

ASTM D 1505: resin density

ASTM D 5199: thickness

ASTM D 638: tensile strength

smooth/textured surface



GCL Manufacturing & Installation

Manufacturing Quality Control (MQC)

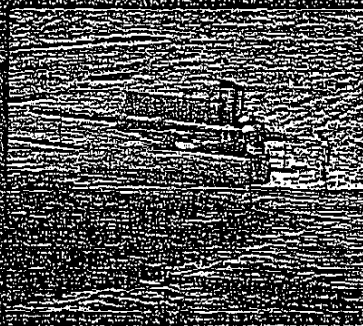
ASTM D 5889

Material Storage & Handling

ASTM D 5888

Installation Guidelines

ASTM D 6102



Geosynthetics for Advanced Solutions

Performance of GM/GCL Composite Liners

EPA study compared leakage rates through three liners:

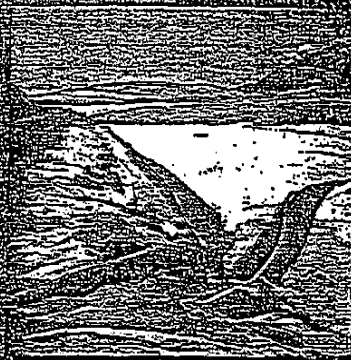
Geomembranes (GM) alone

GM/GCL composite liners

GM/GCL composite liners

56 different cells in the Northeast U.S.

Measured leakage through EDS double liner



Leakage Rates Through Liners

Results from EPA Study (1999)

Less flow through GM/GCL composite liners

Parallel results from Bonaparte & Gross (1990)

GM/GCL leakage = 13.5 gal/ac/day, 7 cells

GM/GCL leakage = 2.9 gal/ac/day, 34 cells

Type of Liner	No. of Cells	Average Leakage Rate gal/ac/day (l/trac/day)
Geomembrane	28	20 (200)
Geomembrane/GCL	11	5 (50)
Geomembrane/GCL	19	0.07 (0.7)

Geosynthetics for Advanced Solutions

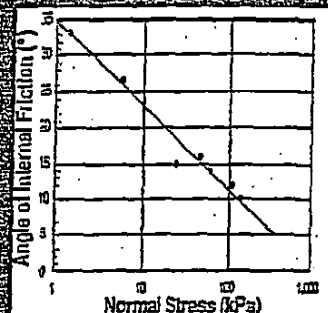
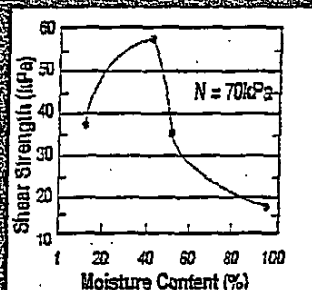
GCL Hydration & Shear Strength

GCL interface internal shear strength is a function of:

1) Bentonite hydration
(Daniel, 1993)

2) Normal loads & bearing capacity
(Daniel, 1993; Stark, 1998)

• Dry bentonite → strength ranges up to 35
• Hydrated bentonite →



3) Type of carrier & migration of bentonite
(Simmet, 1994; Gilvetti, 1996)

GCL Hydration & Shear Strength

Interim & Global Slope Stability Analysis is Crucial
Systems with both Reinforced Fabric GCLs & Un-Reinforced GCLs

Reinforced fabric GCLs

Internal shear strength dependent
upon density & strength of the
stitching

Interface strength dependent upon
type/weight of geotextiles

Woven vs. nonwoven

Bentonite hydration & migration against
adjacent membranes & soils



Geosynthetics for Advanced Solutions

GCL Hydration & Shear Strength

Un-reinforced Geomembrane GCLs

Well documented & understood

Peak post-peak dry & hydrated

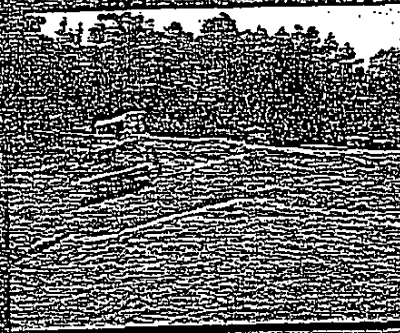
Various slope stability designs developed

(1) Non-encapsulated bentonite

Deployed bentonite side down

Bentonite hydration from subgrade moisture

Applications limited to low loads & gentle slopes



GCL Hydration & Shear Strength

(2) Un-reinforced Encapsulated

Deployed geomembrane down with overlying geomembrane

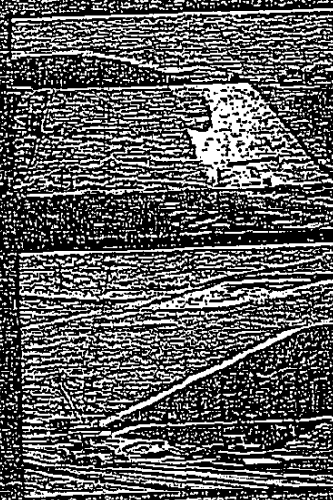
Encapsulates bentonite between geomembranes

Hydration limited to localized breaches & seam edges

Shear strength approaches dry bentonite

Assumptions on extent of hydration

Pro-rated shear strength & FOS



Geosynthetics for Advanced Solutions

GCL Compatibility with Site Soils/Liquids

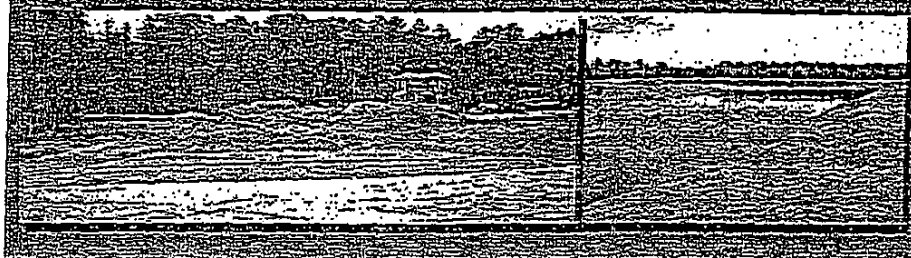
Evaluated by free swell test & fluid loss tests

Prepared or actual leachate from site soils & liquids

Tests conducted by qualified laboratory

Indication of effect on permeability

Hydraulic flux/permeability conducted as practical



GCL Bentonite Compatibility

Site specific liquids & leachates

Typically minimized with pre-hydration (Ruhf & Daniel, 1997)

Site soils

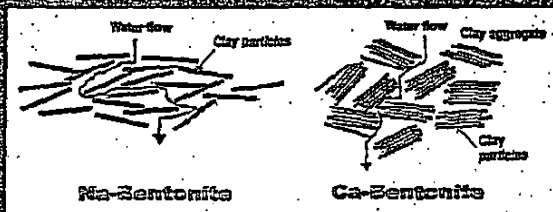
Unprotected Na-bentonite commonly transforms into Ca-bentonite via Cation-Exchange (Egolfstein, 1997)

↓ Interlayer swelling

↑ Interstitial aggregate flow

↓ Swelling potential

↑ Permeability & cracking



Geosynthetics for Advanced Solutions

GCL- Soil Compatibility Field Study

Hamburg, Germany Landfill Site 1994 - present (Melchior 1999)

Deployed GCLs & covered with 450 mm (1.5 ft) sand rich soil

Simulate cap conditions, samples exhumed 1996 & 1998

Performance of unprotected bentonite GCLs

Na-ion fraction: 69% ↓ 4% Ca-ion fraction: 26% ↑ 81%

Reduction of bentonite free swell: 30 ml ↓ 10 ml & clay desiccation

Increase permeability: 7×10^{-10} cm/sec ↑ 1×10^{-7} cm/sec



GCL Soil/Liquid Compatibility

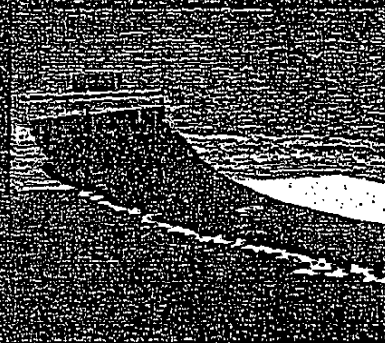
Conclusions by Eglonstein & Melchior

Na-Ca Cation Exchange in unprotected bentonite occurs in typical soils

Negatively alters the swelling & permeability of the bentonite

Adequate protection (geomembrane or suitable soil) will minimize cation exchange

Cation Exchange Capacity (CEC) with site soils & liquids should be considered in design



Geosynthetics for Advanced Solutions

In Summary...

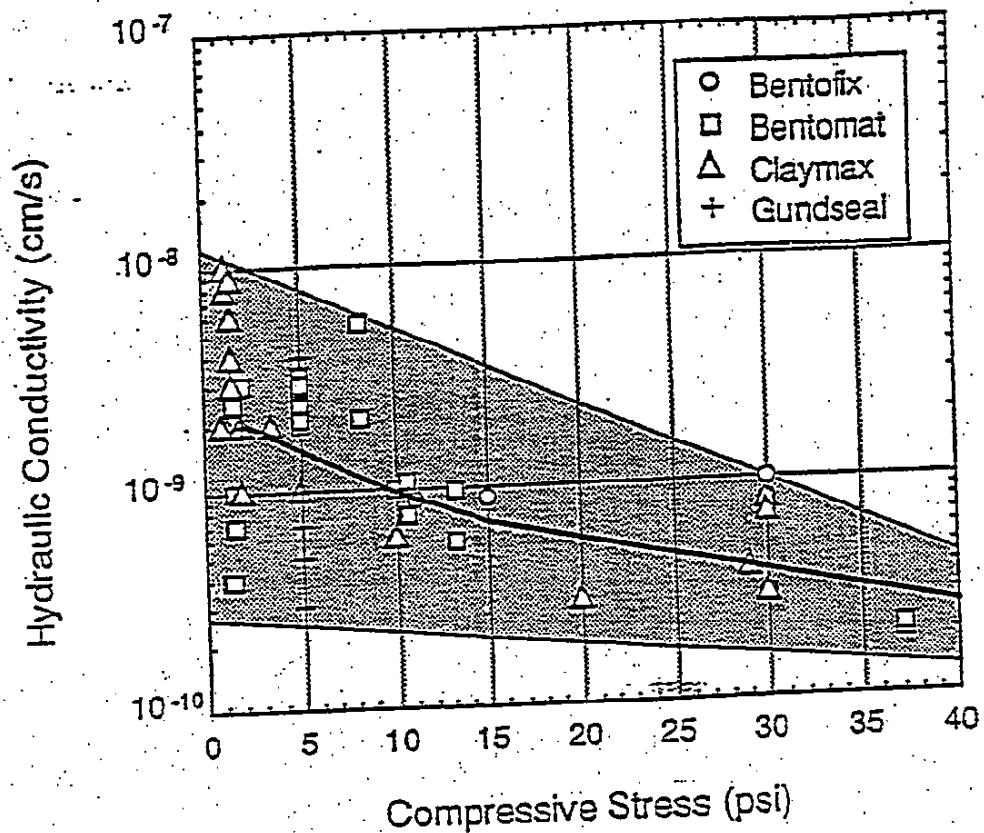
GSE Geomembrane Supported GCL

- One product composite liner
- Replace/augment GCL utilized in GM/GCL composite liners & caps
- Performance criteria:
 - Material properties & installation
 - Leakage rate through GM/GCL
 - Bentonite hydration & slope stability
 - Bentonite compatibility



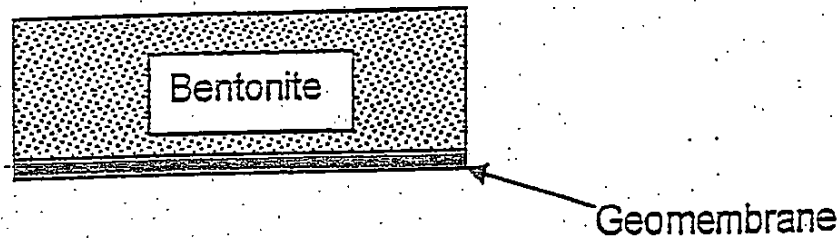
Questions ?

Hydraulic Conductivity of GCLs



Preliminary Results From an EPA
Research Project not yet Published (1999)

EPA Study (1999)

Overall Permeability of Gundseal[®]:

For a 20-mil HDPE Geomembrane:

Water Vapor Transmission (WVT) Rate:

$$WVT \approx 0.02 \text{ g m}^2 / \text{day} \quad (\text{at } 50\% \Delta H_R)$$

$$\approx 7 \times 10^{-11} \text{ cm/s}$$

For a head of 1 ft (30 cm) & $k_{\text{Bentonite}} = 1 \times 10^{-9} \text{ cm/s}$:

$$\text{Flux} = v = k i = (1 \times 10^{-9} \text{ cm/s}) ([30+0.5]/0.5)$$

$$= 6.1 \times 10^{-8} \text{ cm/s}$$

But the actual flux is $< 7 \times 10^{-11} \text{ cm/s}$.Assume flux is $7 \times 10^{-11} \text{ cm/s}$:

$$K_{\text{Equivalent}} = v / i = 7 \times 10^{-11} \text{ cm/s} / ([30+0.5]/0.5)$$

$$= \boxed{1 \times 10^{-12} \text{ cm/s}}$$

EPA Study (1999)

Performance of Overlaps in Tank Tests:

<u>GCL</u>	<u>Overlap?</u>	<u>k (cm/s)</u>
A	No	1×10^{-8}
	Yes	3×10^{-8}
B	No	5×10^{-10}
	Yes	7×10^{-10}
C	No	7×10^{-11}
	Yes	1×10^{-10}
D	Yes	No Flow

Conclusion: Overlaps do self-seal!

EPA Study
(1999)Significance of Hydraulic Conductivity (k):

- Leakage Rate Is Directly Proportional to k
- Compacted Clay Liners (By Regulation) Must Have $k \leq 1 \times 10^{-7}$ cm/s
- For a GCL to Have Equivalent or Less Leakage, k of the GCL Must Be $\approx 1 \times 10^{-9}$ cm/s
- The GCL Must Have Low Initial k and Must Maintain Low k

Exhibit 24
Emergency Response Certification Letters

Emergency Response Certification

**Harold J. "Babe" Landry Landfill
Berwick, St. Mary Parish, Louisiana**

Solid Waste Standard Permit Modification Application (Permit No. P-0193)

Pursuant to LSA-R.S. 30:2157, I certify that the Berwick Volunteer Fire Department does not have the abilities to meet the emergency response requirements of National Fire Protection Association (NFPA) Standard No. 472: "Standard for Professional Competence of Responders to Hazardous Materials Incidents, 1997 Edition" and NFPA Standard No. 473: "Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents, 1997 Edition". The referenced facility, located at 124 Landfill Lane, Berwick, Louisiana, 70342, is within the Berwick Volunteer Fire Department's service area for such emergency responses and any hazardous materials incident at the Harold J. "Babe" Landry Landfill facility would be responded to by Berwick Volunteer Fire Department personnel and equipment.

Berwick Volunteer Fire Department

Signature

Date

Ray A. Raspberry

Fire Chief, Berwick Vol. Fire Dept.

Printed Name

Title

APR-08-2002 MON 03:13 PM ST. MARY PARISH LANDFILL 5043854532

ST. MARY PARISH MUTUAL AID AGREEMENT

The undersigned Fire Departments agree to provide mutual aid services as per the stipulations listed in this agreement.

1. Upon arrival at an emergency incident, the Officer-in-charge of the authority having jurisdiction may request Mutual Aid assistance from any participating department.
2. Upon receipt of the request for Mutual Aid assistance, each department agrees to furnish the equipment and available manpower according to that department's Mutual Aid agreement.
3. If the department requested cannot furnish assistance, that department representative will notify the requesting department's Officer-in-charge immediately, so that alternative measures can be made.
4. All responding departments will be under the command of and yield to the Officer-in charge of the authority having jurisdiction.
5. This agreement supersedes any previous agreement and will remain in force for five (5) years from the date signed. This agreement may be terminated within ninety (90) days upon a written notification to the participating departments.

Cecil A. McElwaine
FIRE CHIEF, AMELIA VOLUNTEER FIRE DEPT.

5/27/99
DATE

Gene St. Germain
FIRE CHIEF, BALDWIN VOLUNTEER FIRE DEPT.

5/27/99
DATE

Daniel J. Perry
FIRE CHIEF, BAYOU VISTA VOLUNTEER FIRE DEPT.

5/27/99
DATE

Janet Guillot
FIRE CHIEF, BERWICK VOLUNTEER FIRE DEPT.

5/27/99
DATE

allan J. P. L.
FIRE CHIEF, CENTERVILLE VOLUNTEER FIRE DEPT.

11/17/99
DATE

Anthony Koch
FIRE CHIEF, CHARENTON VOLUNTEER FIRE DEPT.

8-26-99
DATE

Shelby Bryant
FIRE CHIEF, CYPRE MONT POINT VOL. FIRE DEPT.

12-9-99
DATE

Mark M. L.
FIRE CHIEF, FOUR CORNERS VOLUNTEER FIRE DEPT.

5-27-99
DATE

Tim V. Thibault
FIRE CHIEF, FRANKLIN VOLUNTEER FIRE DEPT.

5-27-99
DATE

Michael S. Raymond
FIRE CHIEF, MORGAN CITY FIRE DEPT.

6-11-99
DATE

AMELIA

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

- A) Number of fire apparatus
B) Number of ariel apparatus
C) Number of firefighting personnel
D) Number of Chief officers

1
0
4
1

- 2) Specialized equipment available:

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

AMELIAVED
DEPARTMENT

Keith LeBlanc
FIRE CHIEF

5/27/99
DATE

APR-08-2002 MON 03:17 PM ST. MARY PARISH LANDFILL 5043854532

P. 04

BERWICK

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

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- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

- A) Number of fire apparatus
B) Number of ariel apparatus
C) Number of firefighting personnel
D) Number of Chief officers

AVAILABLE FOR MUTUAL AID	AVAILABLE FOR BERWICK
1	1 1/2 + 1 RESERVE
1	1 55' AERIAL
5	25
1	2

- 2) Specialized equipment available:

55' LADDER / PUMPER w/ 2 MEN

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

2 EA PORTABLE DECK GUN w/ STRAIGHT BORE NOZZLE
20 GALLONS FFF FOAM
5 PERSONNEL WITH FIRE FIGHTING EQUIPMENT

BERWICK VOL.
DEPARTMENT

RAY RASBERRY
FIRE CHIEF

JUNE 6, 1999
DATE

MORGAN CITY

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

A) Number of fire apparatus	<u>1</u>
B) Number of ariel apparatus	<u>1</u>
C) Number of firefighting personnel	<u>8</u>
D) Number of Chief officers	<u>1</u>

- 2) Specialized equipment available:

1 - 85' Snorkel, 1 - Ozzie nozzle (Automatic side-to-side sweeping motion master stream,
75 - 5 gallon containers 3% - 6% AFFF (ATC) foam, 25 - 5 gallon containers 3% AFFF
foam, Confined space rescue personnel (Not always available), High angle rescue
personnell (Not always available), Haz-mat trained personnel (Not always available).

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

Morgan City Fire
DEPARTMENT

Michael D. Raymond 5-24-99
FIRE CHIEF DATE

**FIRE DEPARTMENT***City of Morgan City*

P. O. Box 2622

MORGAN CITY, LA 70381

TIMOTHY MATTE
MAYOR**MICHAEL RAYMOND**
FIRE CHIEF**Mutual Aid Resources Available**

In the event of another department requesting Morgan City Fire Department's assistance for fire fighting or any other situation, the following resources will be available:

- 1) One apparatus manned with one officer, one operator, and whatever on duty firefighters available for that platoon.
- 2) A maximum of six (6) off duty personnel will be dispatched to the call.
- 3) The chief officer on call will respond to the call only if another chief officer is available to cover call within the city.
- 4) Specific equipment will be dispatched as requested. (Example: Snorkel 1)
- 5) Additional manpower and/or equipment may be dispatched depending on the availability and each individual situation.

Available resources:

- 1 85' Snorkel
- 1 Ozzie nozzle (Automatic side-to-side motion)
- 75 5 gal. containers 3% - 6% AFFF (ATC) foam
- 25 5 gal. containers 3% AFFF foam
- Confined Space Rescue trained personnel (Not always available)
- High Angle Rescue personnel (Not always available)
- Hazardous materials trained personnel (Not always available)

(05-04-99)

BAYOU VISTA

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

A) Number of fire apparatus	<u>1</u>
B) Number of ariel apparatus	<u>0</u>
C) Number of firefighting personnel	<u>6</u>
D) Number of Chief officers	<u>1</u>

- 2) Specialized equipment available:

UP TO 20 - 5 gallon pails of A13-AFFF Foam
1 Service truck Equipped with lights and a 8-bottle
CASCADE System.

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

2 more pumps, up to 20 line 2 personnel

BAYOU VISTA VOL.
DEPARTMENT

Darryl A. Perry
FIRE CHIEF

11-15-99
DATE



Patterson Volunteer Fire Dept.

1304 MAIN STREET
P. O. BOX 783
PATTERSON, LA. 70392

ST. MARY FIRE ASSOCIATION EQUIPMENT LIST

FOR MUTUAL AID

1-500 GALLON PUMPER TRUCK

1-EQUIPMENT TRUCK

AIR PACKS WITH CASCADE TANKS

MAN POWER

CENTERVILLE

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

A)	Number of fire apparatus	<u>2</u>
B)	Number of ariel apparatus	<u>0</u>
C)	Number of firefighting personnel	<u>10</u>
D)	Number of Chief officers	<u>4</u>

- 2) Specialized equipment available:

50 gallons of Class A foam
50 gallons of foam for Class B fires
H. Pre foam proportioner from system

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

12 Scba's w/ spare cylinders
1500 gpm foam eductor

CVFD

DEPARTMENT

Peter R. Martin 5-29-00

FIRE CHIEF

DATE

FRANKLIN

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

A) Number of fire apparatus	<u>5</u>
B) Number of ariel apparatus	<u>1</u>
C) Number of firefighting personnel	<u>30</u>
D) Number of Chief officers	<u>4</u>

- 2) Specialized equipment available:

2- 500 GPM Foam eductor w/ nozzle
50- pails 3-6% EFFF
Hydraulic extrication tools
Haz-mat personnel

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

1- pumper 1000 gals water 1250 pump
1- ariel 100 ft.
5-10 personnel
extrication equipment
air bags

Franklin
DEPARTMENT

Jim Thibodeaux 5-27-99
FIRE CHIEF DATE

BALDWIN

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

A) Number of fire apparatus	<u>1</u>
B) Number of ariel apparatus	<u>0</u>
C) Number of firefighting personnel	<u>4-6</u>
D) Number of Chief officers	<u>1-2</u>

- 2) Specialized equipment available:

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

DEPARTMENT

FIRE CHIEF

DATE

CHAREN:

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

A)	Number of fire apparatus	<u>2</u>
B)	Number of ariel apparatus	<u>1</u>
C)	Number of firefighting personnel	<u>2 CARPENTER - 25 VOLUN</u>
D)	Number of Chief officers	<u>5</u>

- 2) Specialized equipment available:

① SMEAL FREIGHTLINER, 75' Q UNIT W/ 1200 LD
20 GALLON CLASS A FOAM PRO SYSTEM - 1250 G
② 89 E-ONE - 1250 GPM W/ LDH (5')

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

③ 2000 GALLON TANKER W/ 350 GPM PUMP
W/ DIRECTIONAL DUMP
④ FL80 Heavy RESCUE W/ CASCADE, EXTRICATION
EMS SUPPORT
⑤ TWO Reserve Units, Light RESCUE, 500 GPM P
W/ 1200 3"

CHarenton C. Hittima HA
DEPARTMENT

[Signature]
FIRE CHIEF

9-1-96
DATE

FOUR CORNERS

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

- A) Number of fire apparatus
B) Number of ariel apparatus
C) Number of firefighting personnel
D) Number of Chief officers

<u>3</u>	<u>1</u>
<u>0</u>	<u>0</u>
<u>27</u>	<u>4</u>
<u>0</u>	<u>1</u>

- 2) Specialized equipment available:

Air system, Tanker-pumper - drop tanks

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

Tanker-pumper, 1 ~~fire~~ engine 2 Fire Fighters

Four Corners VFD
DEPARTMENT

Mark M. Lewis
FIRE CHIEF

5-18-02
DATE

CYPREMORT POINT

ST. MARY PARISH FIRE ASSOCIATION

MUTUAL AID QUESTIONNAIRE

We are in the process of updating the resources available for Mutual Aid response in St. Mary Parish. The information requested below is needed in order to complete this update. Please complete this form as soon as possible and return it to Keith LeBlanc.

- 1) Upon request for Mutual Aid, the following equipment and personnel will be made available:

A)	Number of fire apparatus	<u>0</u>
B)	Number of ariel apparatus	<u>0</u>
C)	Number of firefighting personnel	<u>5</u>
D)	Number of Chief officers	<u>1</u>

- 2) Specialized equipment available:

None

- 3) In the event additional assistance is needed, the following equipment and manpower may be made available:

None

Cypremort Point VFD
DEPARTMENT

Nicky Bernard
FIRE CHIEF

5-18-00
DATE

Emergency Response Certification

**Harold J. "Babe" Landry Landfill
Berwick, St. Mary Parish, Louisiana
Solid Waste Standard Permit Modification Application (Permit No. P-0193)**

Pursuant to LSA-R.S. 30:2157, I certify that Acadian Ambulance has the abilities to meet the emergency response requirements of NFPA Standard No. 473: "Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents, 1997 Edition". The referenced facility, located at 124 Landfill Lane, Berwick, Louisiana, 70342, is within Acadian Ambulance's service area for such emergency responses and any hazardous materials incident at the Harold J. "Babe" Landry Landfill facility would be responded to by Acadian Ambulance personnel and equipment.

Acadian Ambulance

Signature

Date

Printed Name

Title

Emergency Care Certification

Harold J. "Babe" Landry Landfill
Berwick, St. Mary Parish, Louisiana
Solid Waste Standard Permit Renewal Application (Permit No. P-0193)

Pursuant to LSA-R.S. 30:2157, I certify that the Lakewood Medical Center has the ability to accept and treat patients who are contaminated with hazardous materials.

Lakewood Medical Center

Clifford M. Broussard
Signature

August 8, 2000
Date

Clifford M. Broussard
Printed Name

Chief Executive Officer
Title



St Mary Parish Government

Attn: Henry LaGrange

5th Floor Court House Building

500 Main St.

Franklin, LA 70538

EMERGENCY RESPONSE CAPABILITIES

Environmental Safety and Health Consulting Services, Inc. (ES&H) is pleased to offer our emergency response resources to the St. Mary Parish Government.

ES&H can have the necessary resources to most locations within St. Mary Parish within 1 hour of notification. ES&H resources will be provided based on availability at the time of notification.

Any questions or comments regarding these provisions may be directed to Pat Bergeron or Kevin Voisin at (877)-4-ES and H or by the e-mail addresses listed below.

Respectfully,

Kevin Voisin

Environmental Consultant

Environmental Safety and Health Consulting Services, Inc.

kevin@esandh.com

Pat Bergeron, R.E.M.

Consulting Division Manager

Environmental Safety and Health Consulting Services, Inc.

pat@esandh.com

1730 Coteau Rd.
Houma, LA 70364

24-Hour Toll Free Number: 1-877-4ES and H
504-851-5350
504-853-1973 fax
www.esandh.com



EMERGENCY RESPONSE

INDUSTRIAL SERVICES

TRANSPORTATION SERVICES

SITE REMEDIATION AND RESTORATION

N.O.R.M. WORK

PRODUCTS DISTRIBUTOR

Any Emergency. Anywhere. Anytime.

BEST COPY



OUR VISION

ES&H strives to be the best environmental services company on the Gulf Coast. We are dedicated to serving our clients with honesty, professionalism, experience and timely service, all at highly competitive rates. Through a combination of internal quality controls and welcomed customer input, ES&H honors its commitment to continually improve our service and satisfy the growing demands of customers, industry and environment.

COMPANY PROFILE

ES&H is a full-service environmental firm headquartered in Houma, Louisiana. Years of corporate experience coupled with management's dedication to excellence in customer satisfaction have earned ES&H its place as an industry pacesetter.

Through an extensive range of environmental services, ES&H actively meets the needs of the oil and gas industry, petrochemical industry, federal, state and local governments, plants, transportation companies, maritime industry, individuals and countless others.

ES&H specializes in emergency response to oil and hazardous materials spills with equally skilled divisions providing industrial cleaning services, waste transportation and disposal, product sales and NORM remediation.

With seven response offices strategically located throughout Louisiana, ES&H is positioned to handle any emergency, anywhere, at any time.

Oil Spill Emergency Response

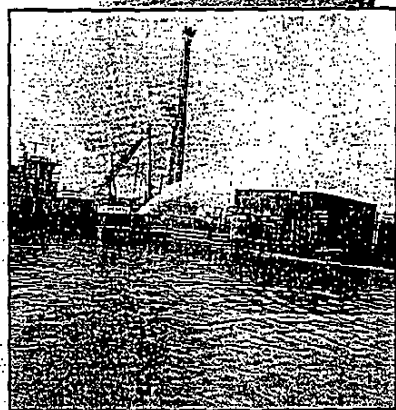
When environmental emergencies strike, time does not permit second-guessing. Trust ES&H for dependable emergency response you can rely on from onset to conclusion.

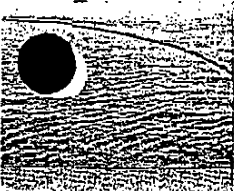
Specializing in oil and other hydrocarbon spills, ES&H's qualifications are irrefutable. ES&H has been involved in the clean-up efforts of some of the largest oil spills along the Gulf Coast over the past five years. Our organization also holds the United States Coast Guard's highest ranking as a level "E" certified Oil Spill Removal Organization (OSRO).

ES&H is prepared to conquer any challenging oil spill. We served as the primary OSRO for a pipeline rupture that sent approximately 1,000 barrels of oil into an inland marsh in South Louisiana. Our team responded when a barge overflowed into the Intracoastal Canal in Houma. ES&H took action when a blowout triggered by a well failure occurred during a work-over operation in Grand Chenier, Louisiana.

When you select ES&H as your emergency responder, you receive the best in experience and technology. Utilizing seven response locations throughout Louisiana, ES&H is able to provide comprehensive Gulf Coast coverage and rapid response times.

Our professionally trained emergency response personnel are HAZWOPER certified HAZ-MAT Technicians outfitted with top-notch equipment that will serve them in all environments and applications. ES&H also provides on-site response equipment, and our team is available to participate in your organization's boom deployment exercises.





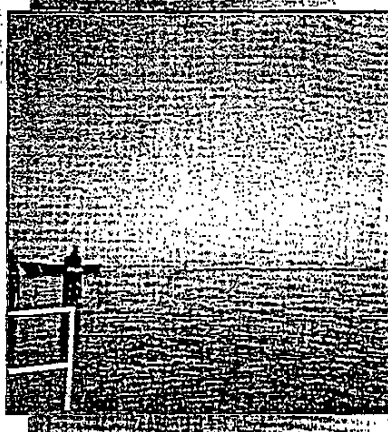
Equipment Deployment Exercises

Exercises or Emergencies, ES&H is your guiding light.

ES&H is fully capable of assisting your organization with maintaining its regulatory compliance by conducting equipment deployment exercises for your various facilities. Our personnel are professional spill responders that are experts in deploying boom and operating various skimming systems. The ES&H team can either supply the containment boom or utilize your organization's containment boom on location, then clean, repair and replace it in its original storage area once the spill is complete.

We can also handle the regulatory paperwork that is required for these exercises. Upon completion of your exercise, ES&H will leave a paperwork trail that consists of proper PREP certification, documenting successful equipment utilization, a list of personnel that participated in the drill, lessons learned and many other mandated areas.

Call today and let our 24 hour, 7 day a week operations center coordinate your equipment deployment exercise with you.



Emergency Response

HAZ-MAT Spill Emergency Response



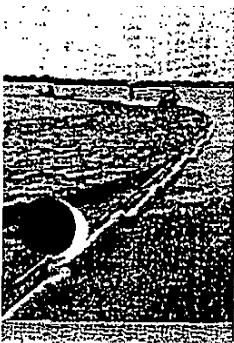
ES&H, the name you trust for any HAZ-MAT situation.

In the wake of a hazardous material spill, the stakes are elevated when life and property are in imminent danger. The choice of emergency responder can be the only difference between tragedy and narrow escape.

ES&H's proficiently skilled emergency response teams bring a sense of comfort to the precarious atmosphere of a hazardous material spill. ES&H responded to a 12-car train derailment in downtown New Iberia that sent xylene flowing into a storm drain. Our team was called to perform a gross decontamination at a Lake Charles rest stop where a truck carrying a cracked polymeric MDI tank began leaking the toxic chemical.

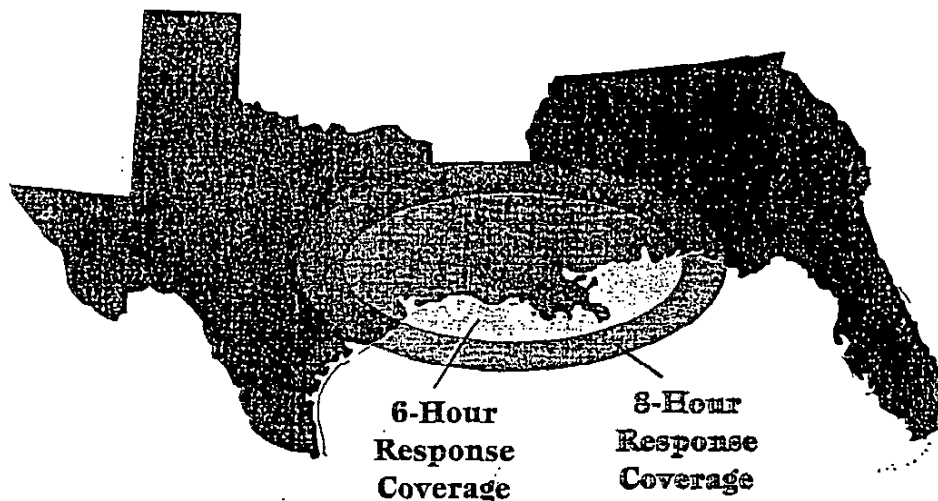
Our level "A" HAZ-CHEM and HAZ-MAT trailers are thoroughly outfitted with the proper response equipment and are ready to respond to any incidents that might occur on the highway, railway or waterway.





Response Office Locations

Emergency Response



BATON ROUGE:

1955 North River Road
Port Allen, LA 70767
Email: batonrouge@esandh.com
Phone: (225) 334-0270
Fax: (225) 334-0212

BELLE CHASSE:

2894 Engineers Road
Belle Chasse, LA 70037
Email: bellechasse@esandh.com
Phone: (504) 398-0017
Fax: (504) 398-0080

FOURCHON:

106 17TH Street
Fourchon, LA 70357
Email: fourchon@esandh.com
Phone: (985) 396-2798
Fax: (985) 396-2660

HOUMA:

1730 Coteau Road
Houma, LA 70364
Email: houma@esandh.com
Phone: (985) 851-5350
Fax: (985) 853-1978

MORGAN CITY:

3189 Highway 70
Morgan City, LA 70380
Email: morgancity@esandh.com
Phone: (985) 385-6730
Fax: (985) 385-6745

NEW IBERIA:

2917 Fairchild Drive
New Iberia, LA 70562
Email: newiberia@esandh.com
Phone: (337) 365-9890
Fax: (337) 365-9892

VENICE:

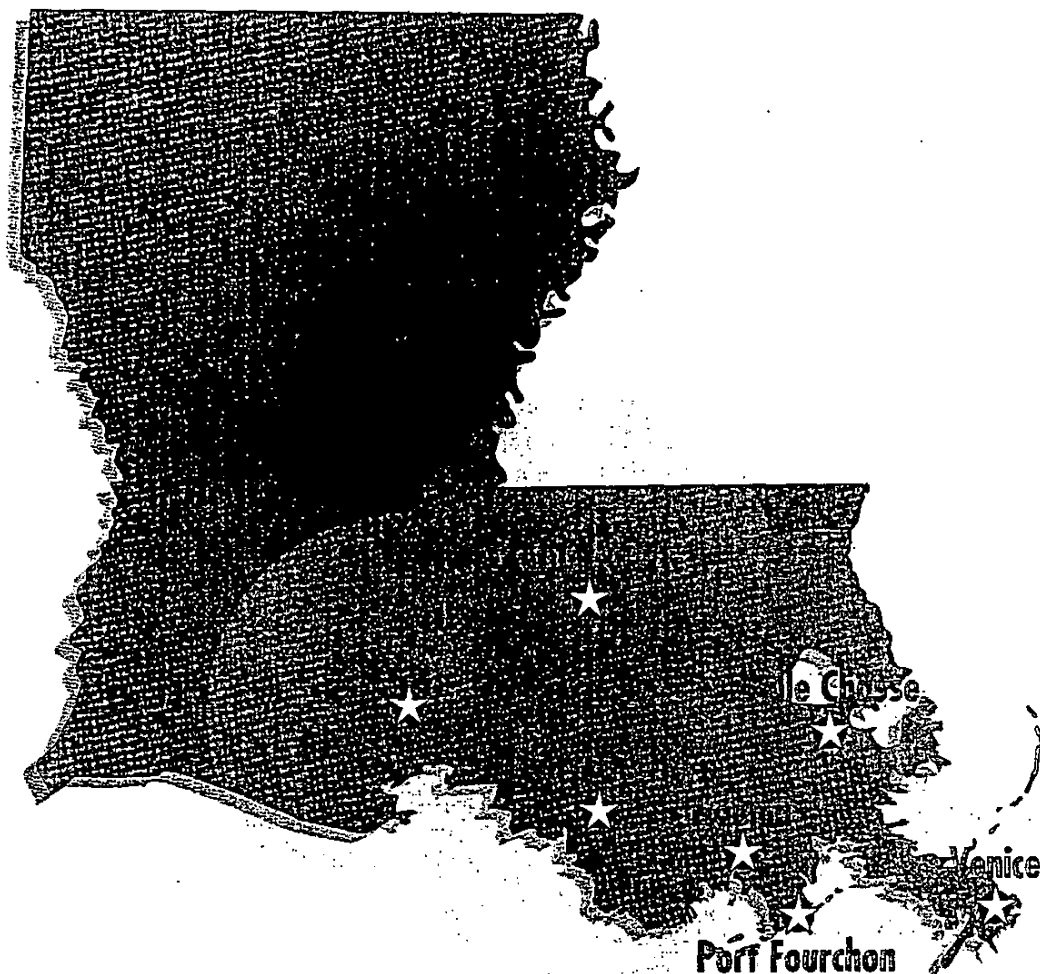
339 Coast Guard Road
Venice, LA 70091
Email: venice@esandh.com
Phone: (985) 534-2616
Fax: (985) 534-2608

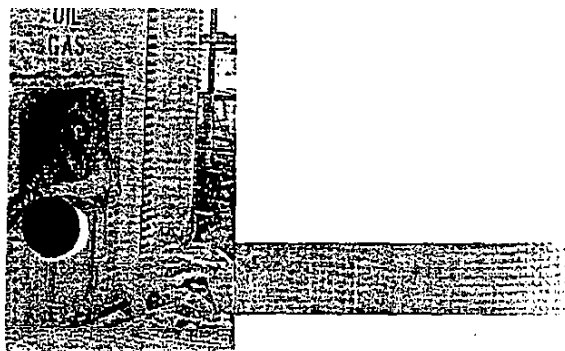
2-Hour Response Coverage



Also included in our two-hour response coverage...

- Alexandria, LA
- Bogalusa, LA
- Lake Charles, LA
- McComb, MS
- Gulfport, MS





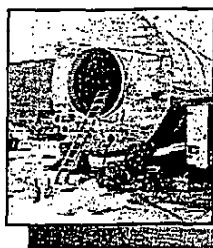
Industrial Services

Professional Knowledge. Proven Experience. Quality Service.

ES&H is a leading provider of integrated, quality industrial cleaning and related facilities support services along the Gulf Coast. Our Industrial Division is trained and equipped to serve you in any capacity.

Through extensive knowledge and experience, ES&H has mastered the techniques to handle any size and type of tank or barge cleaning project. In addition to industrial and marine tank cleaning, we offer a variety of industrial services including bilge cleaning, gas freeing, confined-space entry, turnarounds and various plant services.

Our industrial services are in strict compliance with industry standards, as well as federal, state and local regulations. ES&H's Industrial Division is available for emergencies, routine maintenance, specialized jobs and full-time or part-time service arrangements.



Industrial Services

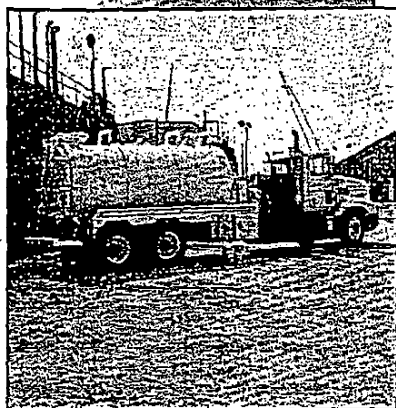
Transportation Services



Solutions. Service. Satisfaction.

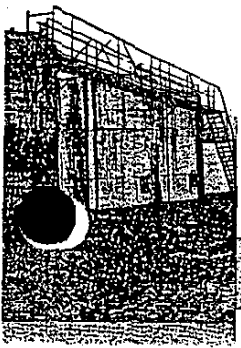
Disposal and transportation can be a cumbersome task for an organization that is not quite sure of how to handle the job. Our transportation services enable ES&H to conduct all jobs from conception to completion, providing the perfect complement to a wide range of emergency response services.

ES&H offers 24-hour dispatching and roll-off box services that include 20-yard and 30-yard box rentals, single rail and double rail transportation, and content disposal. Our waste management program is based on the concept of providing the most cost effective means of disposal while limiting the liability of our customers. While all of our boxes are equipped with a rubber-sealed door to prevent leakage, we also include a liner and tarp cover for added environmental protection. We are responsive to your diverse needs, handling waste streams which include, but are not limited to hazardous, non-hazardous, NORM and NOW waste.



We supply 70-barrel capacity vacuum trucks, several of which are equipped with pressure washing capabilities. In addition, ES&H carries King Vacs for dry product, as well as DOT 407 and DOT 412 regulated Hazardous Materials trucks.

ES&H will sub-contract vacuum boxes and additional equipment or services to meet the specific needs of your company. The Transportation Division employs experienced and reliable CDL-licensed drivers, and all trucks are fully permitted and insured.

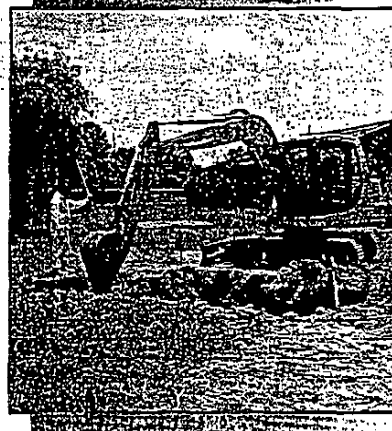


Site Remediation and Restoration

ES&H: Site remediation made simple.

Restoring a contaminated site to a functional condition seems like a simple process. However, remediating a site to meet federal, state and local mandates can be a difficult and overwhelming task. The expertise of the ES&H site remediation team can be utilized to remediate and restore those locations that have suffered environmental devastation.

ES&H will dismantle your abandoned oil field tank batteries, wells and other equipment. After removing the debris, the crew reworks the soil with bioremediation microbes to return the land to its prior state. We offer containment and removal of chemicals and contaminated materials, as well as site excavation. ES&H also performs passive remediation at oil and hazardous materials spill sites using various sorbents.



Environmental Services

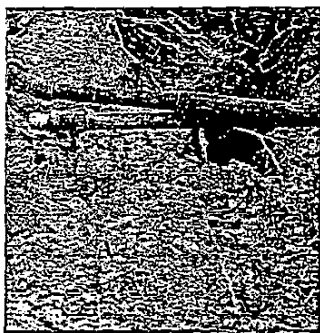
N.O.R.M. Work

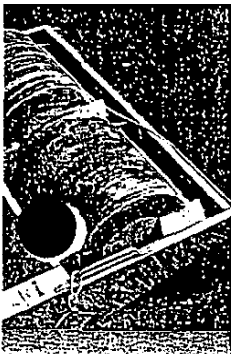
ES&H is your NORM expert on the Gulf Coast.

Naturally Occurring Radioactive Material (NORM) is often found in oil and gas manufacturing facilities, as well as refineries and chemical plants, on occasion. Certain geological configurations contain radioactive elements that are brought to the surface with the fluids. A hazardous localized radioactive source is sometimes created from the elements that become concentrated during production and processing of the oil and gas.

The Louisiana Department of Environmental Quality established the Radiation Protection Division (RPD) in response to the growing concern for NORM. The RPD requires that each oil-producing facility conduct a site survey to detect any areas generating NORM, and post warning signs in these designated areas.

ES&H is Louisiana-licensed as a NORM contractor and has the means to handle removal, disposal and decontamination of Radium 226 and Radium 228. Our team is available for NORM surveys, tank cleaning, removing scale from pipe and other services associated with NORM.





Products

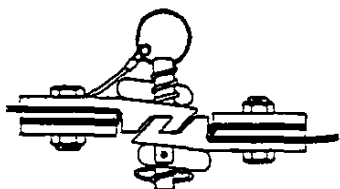
Should you ever need to purchase individual products...

ES&H is an authorized MSA distributor, supplying all levels of Personal Protective Equipment (PPE) including, but not limited to safety glasses, hard hats, gloves and chemical protective suits.

Please call (504) 851-5350 or e-mail houma@esandh.com for all product specifications, pricing, quantities and shipping.

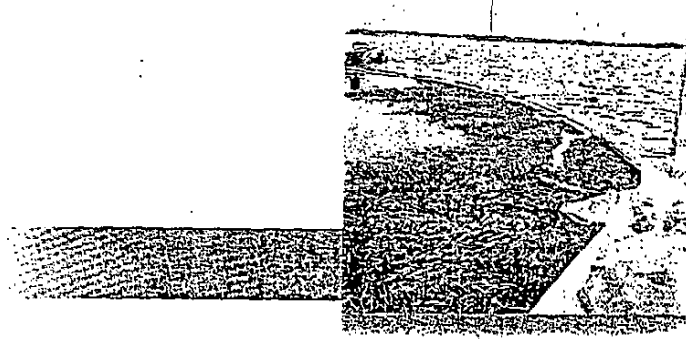
We carry various drum skimmers with recovery rates ranging from 2 to 200 gallons (7.6-760 liters) per minute, as well as rope mop and manta ray skimmers. ES&H also offers a superior line of oil spill kits, HAZ-MAT spill kits and sorbents.

Floating containment booms are manufactured from a variety of flexible thermoplastic fabrics that are extremely durable. ES&H carries a range of sizes for multiple applications including 6", 10", 18", 24" and even 36" boom. The flex coupler (see diagram below) is used for permanent or semi-permanent installations when connecting sections of containment boom; it comprises stainless steel lock nuts, bolts, washers, and a pre-punched neoprene rubber gasket to provide a positive seal.



Environmental Products

Products



Choose among our various spill kits available for rental or purchase...



ESH 1000 Spill Kit

- (1) 48" x 44" x 29" plastic container with lid
- (160) feet of 5" absorbent boom
- (2) bales of absorbent pads
- (1) 10 lb. anchor
- (1) 50' roll of 1/4" nylon rope
- (2) oil snares
- (2) tubes of repair putty
- (2) Tyvek suits
- (5) Pollution bags
- (2) pair of PVC gloves
- (1) heavy-duty plastic shovel
- (2) bags of oil dry



ESH 95 Spill Kit

- (1) 95-gallon over pack
- (40) feet of 5" absorbent boom
- (2) bales of absorbent pads
- (2) Pollution bags
- (2) oil snares
- (4) Tyvek suits
- (4) pair of PVC gloves
- (1) tube of repair putty

These sorbents are also sold separately:



- 5" and 8" boom
- Pads
- Rugs
- Rolls
- Socks



ESH 55 Spill Kit

- (1) 55-gallon drum
- (40) feet of 5" absorbent boom
- (1) bale of absorbent pads
- (2) Pollution bags
- (2) oil snares
- (2) Tyvek suits
- (2) pair of PVC gloves
- (1) tube of repair putty

When environmental emergencies strike...

Trust ES&H for dependable emergency response.



ES&H 
Environmental Safety and Health Consulting Services Inc.

CORPORATE HEADQUARTERS

TEL: 985-851-5350

24-HOUR TOLL FREE: 877-4-ESANDH OR 888-422-3622

FAX: 985-853-1978

1730 COTEAU ROAD, HOUMA, LOUISIANA 70364

WWW.ESANDH.COM

Exhibit 25

St. Mary Parish Solid Waste Resolution

RESOLUTION

BE IT RESOLVED, by the St. Mary Parish Council in regular session convened this 12th day of September, 1990, that no solid waste be accepted at the Harold J. "Babe" Landry Solid Waste Reduction Facility from any areas which are more than five (5) miles outside the boundaries of St. Mary Parish, and none shall be accepted from any municipal corporation whatsoever which is located outside the boundaries of St. Mary Parish, Louisiana.

BE IT FURTHER RESOLVED, that no permits be granted to any person, firm, or corporation for the purpose of transporting solid waste to the facility where such solid waste is derived from areas outside the five (5) mile radius.

BE IT FURTHER RESOLVED, that the tipping fee for acceptance of solid waste within the five (5) mile radius be established at \$25.00 per ton.

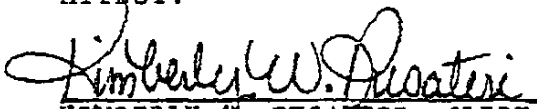
BE IT FURTHER RESOLVED, that should it become necessary to adjust this fee the ratio used to determine the cost between acceptance of Parish solid waste at \$19.00 per ton and acceptance of solid waste within the five (5) mile radius at \$25.00 per ton be used to calculate the new tipping fees.

ADOPTED AND APPROVED by the St. Mary Parish Council in regular session convened on this the 12th day of September, 1990.

APPROVED:


HAROLD G. CLAUSEN, CHAIRMAN
ST. MARY PARISH COUNCIL

ATTEST:


KIMBERLY W. PUSATERI, CLERK
ST. MARY PARISH COUNCIL

NATURE SAVER™ FAX MEMO 01616		Date	9/19/02	# of pages	1
To	Pat Forbes	From	Bo LaGrange		
Company	Turner Env.	City	St. Mary Parish		
Phone #		Phone #	337-828-4100 x 500		
Fax #	225-926-4360	Fax #	337-828-4092		

NATURE SAVER™ FAX MEMO 01616		Date	9/19/02	# of pages	1
To	Tom Turner	From	Bo LaGrange		
Company	Turner Env.	City	St. Mary Parish		
Phone #		Phone #	337-828-4100 x 500		
Fax #	225-926-4360	Fax #	337-828-4092		

Exhibit 26

LDOTD and St. Mary Parish Letter of Approbation (Roads)



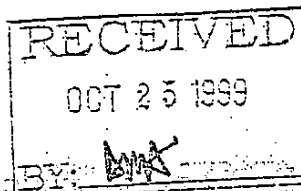
M. J. "MIKE" FOSTER, JR.
GOVERNOR

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
PO BOX 3848
LAFAYETTE, LOUISIANA 70502



KAM K. MOVASSAGHI
SECRETARY

October 19, 1999



Mr. Patrick Forbes
Turner Environmental, Inc.
7918 Wrenwood Blvd., Ste. C
Baton Rouge, LA 70809

Dear Mr. Forbes:

In response to your correspondence dated October 8, 1999 regarding the Harold J. "Babe" Landry Landfill in St. Mary Parish, the following information is submitted:

The Department has reviewed the submitted site plan as well as the access roads to the facility and concluded that the proposed improvements will NOT adversely impact traffic flow or the structural integrity of the state maintained roadways.

In closing, if additional information is needed regarding this matter, please contact this office at your earliest convenience.

Sincerely,

WILLIAM K. FONTENOT, JR.
DISTRICT ENGINEER ADMINISTRATOR

WKF/FAS/al
Cc: Visual Info

ST. MARY PARISH GOVERNMENT

WILLIAM A. "BILL" CEFALU, PRESIDENT

FIFTH FLOOR - COURTHOUSE

FRANKLIN, LOUISIANA 70538-6198

September 5, 2000

HENRY "BO" LAGRANGE
CHIEF ADMINISTRATIVE OFFICER

DIRECTOR OF FINANCE
SUE CARTER

DIRECTOR OF PERSONNEL
TAMMY CHARPENTIER

DIRECTOR OF PLANNING
CAROL J. VINNING

DIRECTOR OF
ECONOMIC DEVELOPMENT
GLEN P. COLLINS

FRANKLIN AREA
(337) 828-4100
MORGAN CITY AREA
(504) 385-2520

JEANERETTE AREA
(337) 276-3869
FAX (337) 828-4092

OFFICE HOURS
8:00 A. M. TO 12:00 P. M.
1:00 P. M. TO 4:30 P. M.

To Whom It May Concern:

Re: Horizontal Expansion of the
Harold J. "Babe" Landry Landfill
St. Mary Parish, Louisiana

The proposed horizontal expansion of the Harold J. "Babe" Landry Landfill is situated adjacent to the existing permitted site. This landfill is located on Thorguson Road, which is designed to handle heavy truck traffic. Approximately 225 tons per day of Municipal Solid Waste (MSW) is currently accepted at the landfill for disposal. Existing roadways are adequate for the anticipated traffic volume to the landfill.

Sincerely,

ST. MARY PARISH GOVERNMENT

HENRY C. LAGRANGE
CHIEF ADMINSTRATIVE OFFICER

HCL/bgp
Xc:file

Exhibit 27

Example of Document to be Filed with Parish Upon Closure

**Document to be Filed in the Parish
Records Upon Final Closure of a
Solid Waste Disposal Facility**

(Name of permit holder) hereby notifies the public that the following described property was used for the disposal of solid waste. This site was closed on (date facility was closed) in accordance with the Louisiana Administrative Code, Title 33, Part VII. Inquiries regarding the contents of **(the facility)** may be directed to **(name of person with knowledge of the contents of the facility)** at **(address of person with knowledge of the content of the facility)**

Property Description:

(Provide the specific description of the location of the facility)

Signature of Person Filing Parish Record

Typed Name and Title of Person Filing Parish Record

Date

Exhibit 28
Alternative Site Evaluation Map

Exhibit 29

**USACE Wetlands Demonstrations (1976 & 1998) & Wetlands
Jurisdictional Determination (2001)**



DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60287
NEW ORLEANS, LOUISIANA 70160

LMNOD-S

13 September 1976

Mr. D. Ralph Caffery, President
D. Ralph Caffery & Associates, Inc.
411 Wall Street
Lafayette, Louisiana 70501

Dear Mr. Caffery:

Reference is made to your letter of 29 June 1976 concerning the need for a US Army Corps of Engineers' permit for the placement of fill material in connection with the construction of a proposed solid waste milling plant and landfill (see inclosure).

We have conducted an onsite inspection of the area and have determined that the 5.051 acre milling plant site and the 496.152 acre fill site in T16S, R12E, are not wetlands subject to our regulatory jurisdiction. Hence, it is not necessary to secure a Section 404 permit from this agency prior to construction of the proposed solid waste milling plant and landfill.

The letter dated 30 July 1976 from Mr. P. A. Hoppe, Jr., of your office concerning rights-of-way requirements has been forwarded to our Real Estate Division for reply.

Please advise if we may be of further assistance.

Sincerely yours,

HENRY R. SCHORR
Acting Chief, Operations Division

1 Incl
Map

Exhibit I



DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT CORPS OF ENGINEERS

P.O. BOX 60257

NEW ORLEANS, LOUISIANA 70160-0257

December 18, 1998

REPLY TO
ATTENTION OF:

Operations Division
Surveillance and Enforcement Section

Mr. P. A. Hoppe, Jr.
Professional Engineering and
Surveying Co., Inc.
411 Wall Street
Lafayette, Louisiana 70506-3029

Dear Mr. Hoppe:

Reference is made to your request for a U.S. Army Corps of Engineers' (Corps) jurisdictional determination on property located in Section 4, Township 16 South, Range 12 East, St. Mary Parish, Louisiana (enclosed map). Specifically, this property is identified as a proposed construction and demolition debris landfill area south of US Highway 90 near Berwick, Louisiana.

Written jurisdictional decisions without a specific time limit imposed, such as the September 13, 1976 determination included with your request, were valid through August 14, 1992. The Corps had authority to extend the validity of an expired determination through August 14, 1997, if the applicant fully demonstrated that substantial resources had been expended or committed based on the otherwise expired determination. The Corps cannot extend the validity of the above referenced determination beyond August 14, 1997, therefore, it has expired.

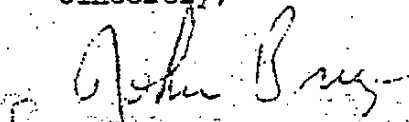
Based on review of recent maps, aerial photography, and soils data, we have determined that this property is not in a wetland subject to Corps' jurisdiction. A Department of the Army permit under Section 404 of the Clean Water Act will not be required for the deposition or redistribution of dredged or fill material on this site. However, wetlands have been identified in the immediate vicinity of this property. Any expansion of your project area will require a revised determination.

You are advised that this determination is valid for a period of five years from the date of this letter unless new information warrants revision prior to the expiration date.

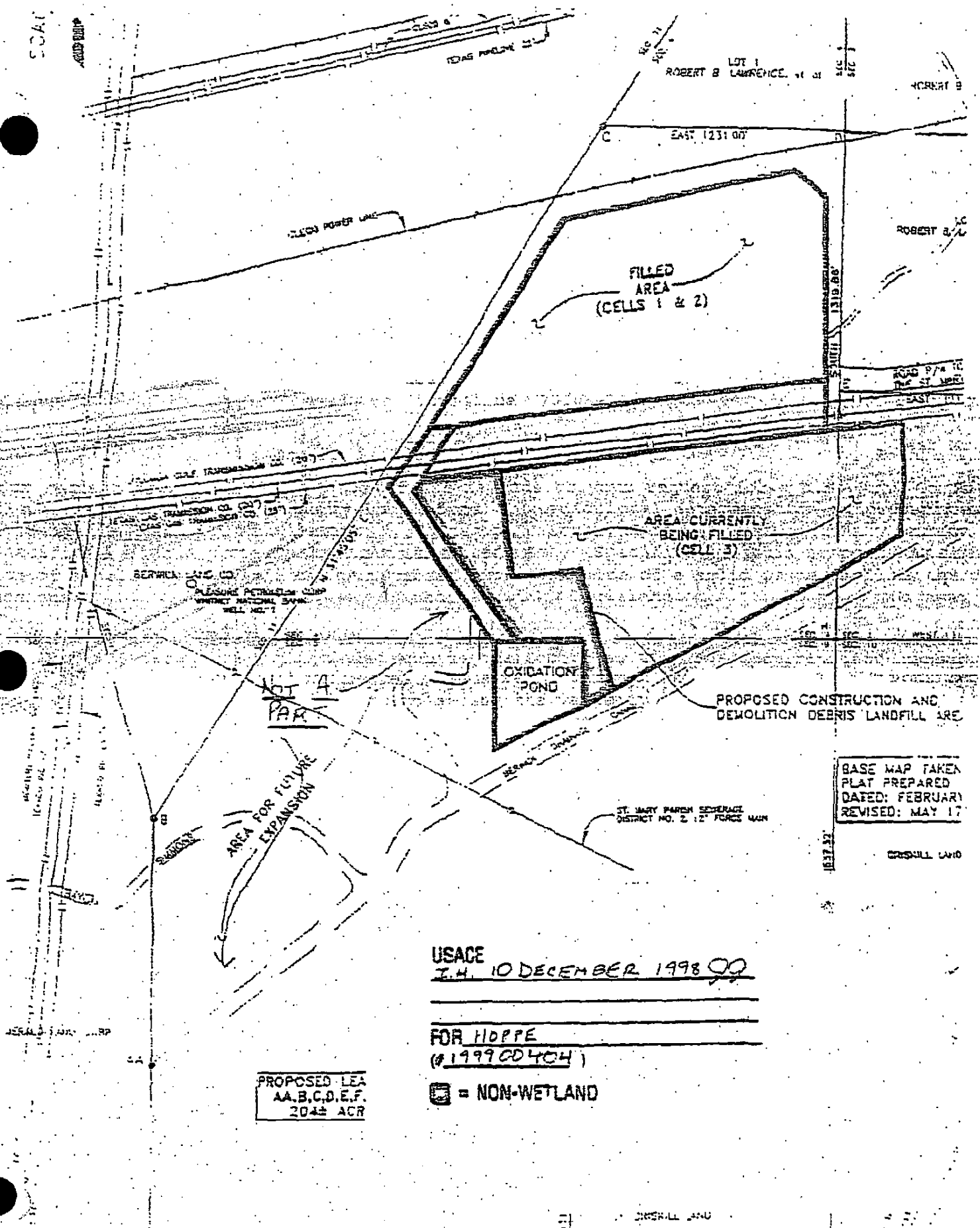
-2-

Should you have any questions concerning this determination,
please contact Mr. James Joyner at (504) 862-1315 and reference our
Account No. 199900404.

Sincerely,


Ronald J. Ventola
Chief, Regulatory Branch

Enclosure



DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT CORPS OF ENGINEERS

P.O. BOX 50257

NEW ORLEANS, LOUISIANA 70160-0257

December 18, 1998



REPLY TO
ATTENTION OF:

Operations Division
Surveillance and Enforcement Section

Mr. P.A. Hoppe
Professional Engineering and
Surveying Co., Inc.
411 Wall Street
Lafayette, Louisiana 70506-3029

Dear Mr. Hoppe:

Reference is made to your request for a U.S. Army Corps of Engineers' (Corps) jurisdictional determination on property located in Section 9, Township 16 South, Range 12 East, St. Mary Parish, Louisiana (enclosed map). Specifically, this property is identified as the proposed expansion site of a solid waste facility south of US Highway 90 near Berwick, Louisiana.

Written jurisdictional decisions without a specific time limit imposed, such as the September 13, 1976 determination included with your request, were valid through August 14, 1992. The Corps had authority to extend the validity of an expired determination through August 14, 1997, if the applicant fully demonstrated that substantial resources had been expended or committed based on the otherwise expired determination. The Corps cannot extend the validity of the above referenced determination beyond August 14, 1997, therefore, it has expired.

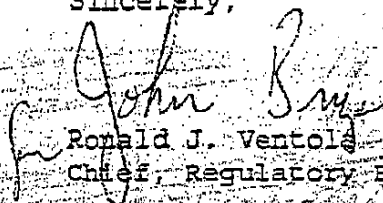
Based on review of recent maps, aerial photography, and soils data, we have determined that wetland areas subject to Corps' jurisdiction do occur on this property. However, these wetlands cannot be accurately delineated without a field investigation. If an accurate delineation is needed, please furnish us with the field data concerning vegetation, soils, and hydrology that we require for all jurisdictional decisions. A Department of the Army (DA) permit under Section 404 of the Clean Water Act will be required prior to the deposition or redistribution of dredged or fill material into these wetlands.

The fact that a field wetland delineation/determination has not been completed does not alleviate your client's responsibility to obtain the proper DA permits prior to working in wetlands occurring on this property.

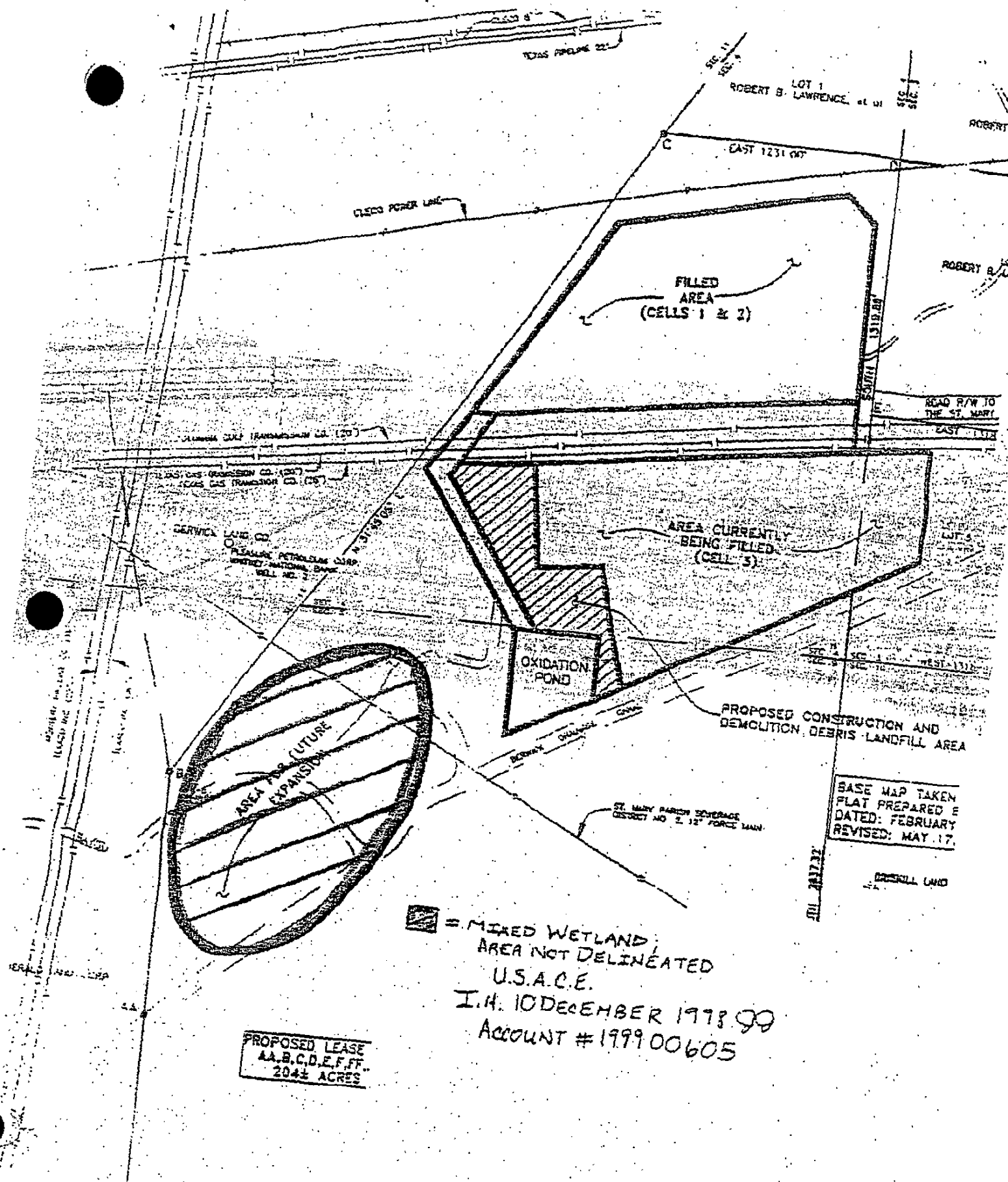
-2-


Should you have any questions concerning this determination, please contact Mr. James Joyner at (504) 862-1316 and reference our Account No. 199900605. If you have specific questions regarding the permit process or permit applications, please contact our Western Evaluation Section at (504) 862-1704.

Sincerely,


Ronald J. Ventola
Chief, Regulatory Branch

Enclosure



 = MIXED WETLAND
AREA NOT DELINEATED
U.S.A.C.E.
I.H. 10 DECEMBER 1978 99
ACCOUNT # 199900605

PROPOSED LEASE
AA,B,C,D,E,F,FF
204 1/2 ACRES

BASE MAP TAKEN
FLAT PREPARED E
DATED: FEBRUARY
REVISED: MAY 17,

BRISILL LAND

APPROVED
JURISDICTIONAL DETERMINATION




94 ACRES WETLAND

USACE

FI 4/12/01, 4/26/01 GNC, RF, +JP

ACCT. NO. WK 20-000-3698

ST. MARY PARISH GOVT - LANDFILL

-  = SEC. 404 WETLAND
-  = NONWET
-  = SEC. 404 OTHER WATER

Ⓢ = SAMPLE SITES

SCALE: 1" = 600'



SECTION 4

SECTION 11

SECTION 4

EXISTING

LANDFILL

WARDS 8 & 9
 REGIONAL SEWERAGE
 FACILITIES F.M.

FORESTED

WARDS 8 & 9
 REGIONAL SEWERAGE
 FACILITIES F.M.

SECTION 9

SECTION 10

SECTION 10

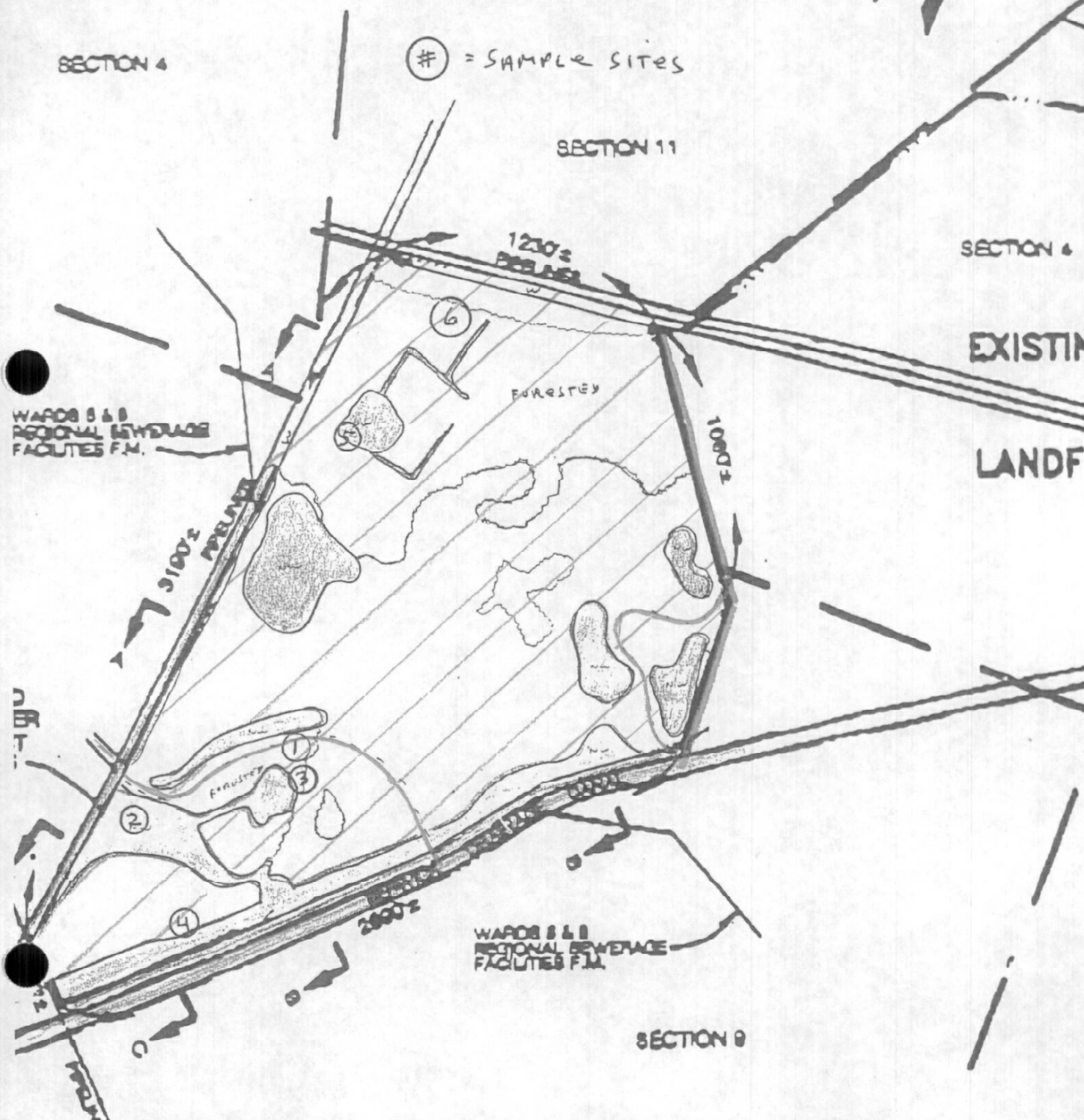


Exhibit 30
USACE Wetlands Permit

May 14 07 02:25p

PENSCO

337 233-8916

P.3



DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT, CORPS OF ENGINEERS

P. O. BOX 50267

NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

01 23 100

Operations Division
Western Evaluation Section

SUBJECT: WI-20-COC-3968

St. Mary Parish Government
PENSCO
411 Wall Street
Lafayette, Louisiana 70536

Gentlemen:

Enclosed is a permit dated this date, subject as above, authorizing work under the Department of the Army permit program.

You are again reminded that any work not in accordance with the plans is subject to removal regardless of the expense and the inconvenience that such removal may involve and regardless of the date when the discrepancy is discovered.

Your attention is directed to all the terms and conditions of the approval, especially those conditions relative to supervision and approval of work by the District Engineer. In order to have the work finally approved and declared legal, all terms and conditions of the permit and plans shown on the drawings attached thereto, must be rigidly adhered to.

It is necessary that you notify the District Engineer, Attention: Regulatory Branch, Western Evaluation Section, in writing, prior to commencement of work and also upon its completion. The notification must include the permittee's name, as shown on the permit, and the permit number. Please note the expiration date on the permit. Should the project not be completed by that date, you may request a permit time extension. Such requests must be received before, but no sooner than, six months before the permit expiration date and must show the work completed and the reason the project was not finished within the time period granted by the permit.

A copy of Page 1 of the permit (ENG Form 1721) must be conspicuously displayed at the project site. Also, you must keep a copy of the signed permit at the project site until the work is completed.

Sincerely,

A handwritten signature in cursive script, appearing to read "Pete Serio".

Pete Serio
Chief, Western Evaluation Section

Enclosure

May 14 07 02:25p

PENSCO

337 233-9916

p. 4

DEPARTMENT OF THE ARMY PERMIT

Permittee: St. Mary Parish Government

Permit No.: WI-20-000-3968

Issuing Office: New Orleans District

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: Clear, excavate and place fill to expand an existing waste disposal facility, in accordance with drawings attached in six sheets, dated January 17, 2000.

Project Location: Sections 4, 9 and 11, T16S-R12E, southwest of the town of Berwick, in St. Mary Parish, Louisiana.

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on September 30, 2007. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.
2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.
3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.
4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.
5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.
6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

May 14 07 02:26p

PENSCO

337 233-9916

p. 5

Special Conditions:

See Special Conditions on Page 4.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

() Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

() Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other federal, state or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

May 14 07 02:26p

PENSCO

337 233-9916

P.6

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

3. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms conditions of this permit.

Keith A. Cofel
(PERMITTEE)

SEPTEMBER 30, 2002
(DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Pete Serio
Pete Serio, Chief, Western Evaluation Section
for Peter J. Rowan, District Engineer

23 October 2002
(DATE)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE)

(DATE)

May 14 07 02:26p

PENSCO

337 233-9916

p. 7

SPECIAL CONDITIONS:

WI-20-000-3968

7. The permittee shall restore and replant the 11.6 acre area designated as "Area A" and a 16.8 acre area designated as "Area B" on the attached mitigation plan. Restoration will consist of allowing the area to revert naturally, removing of exotic invasive vegetative species including Chinese tallow tree and supplementing natural succession by planting bottomland hardwood mast-producing trees in accordance with the following plan:

a. Plantings will be performed on Area A during the first complete non-growing season (December 15 – March 15) following permit issuance. Area B shall be planted within this non-growing season following utilization of the area by the permittee as a spoil storage site. The permittee shall be allowed to utilize Area B for spoil storage until Cell 4, as designated on the attached plans, has reached its capacity.

b. The one year old seedlings will consist of the following bottomland hardwood mixture planted at a maximum spacing of 12 feet by 12 feet amounting to approximately –300 trees per acre to enhance the habitat value to Louisiana black bears:

Species	% of total composition
American elm (<i>Ulmus americana</i>)	10
bald cypress (<i>Taxodium distichum</i>)	15
bitter pecan (<i>Carya lecontei</i>)	10
persimmon (<i>Diospyros virginiana</i>)	15
water-tupelo (<i>Nyssa aquatica</i>)	10
swamp chestnut oak (<i>Quercus prinus</i>)	10
water oak (<i>Quercus nigra</i>)	20
nuttall oak (<i>Quercus nuttallii</i>)	10

c. Application of appropriate herbicides, control burning and/or mowing shall be conducted as necessary prior to planting activities to eradicate or reduce competition from woody and herbaceous vegetation that could adversely affect seedling survival and/or growth.

d. The permittee/contractor must obtain a seedling survival rate of 50 percent or more at the end of the first complete growing season. If this survival rate is not achieved, additional plantings to replace dead or missing seedlings shall be performed in accordance with recommendations as listed above until 50 percent survivorship is achieved after a complete growing season.

e. The mitigation site must be maintained for a minimum period of 50 years commencing at the attainment of the required 50 percent survival rate of initial seedlings planted. Once established, the mitigation site may not be altered to the extent that it reduces habitat value as a forested wetland. To maintain the value for Louisiana black bears, no timbering will be allowed on the mitigation site.

f. If any portion of the mitigation site is destroyed or adversely impacted, the permittee/contractor will promptly notify the Corps and then restore the affected area or implement equal alternative mitigation, as approved by the Corps.

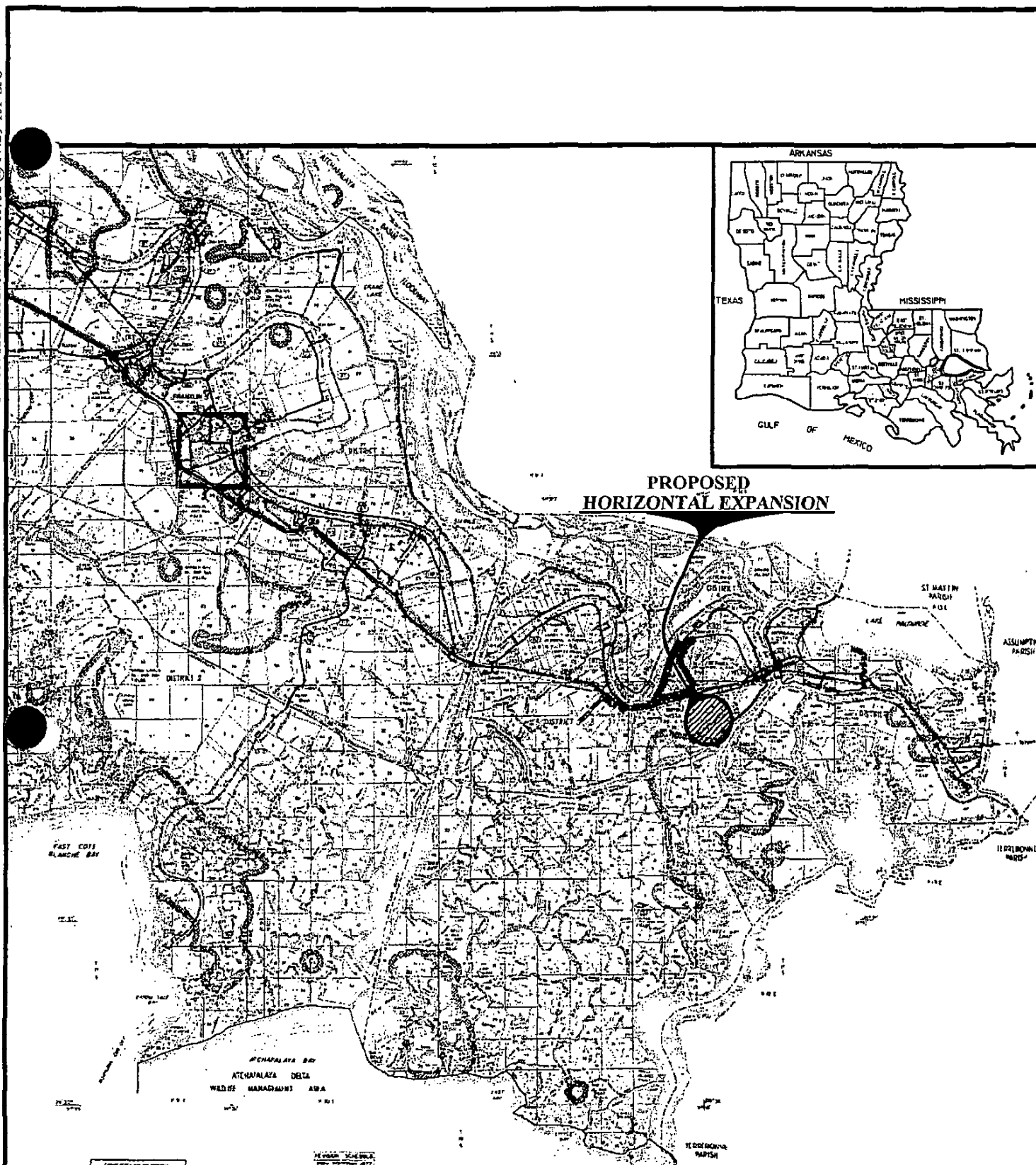
g. The permittee/contractor shall provide to the Corps notification of the attainment of the required survival rate.

8. The permittee shall place a conservation servitude on the 44.4 acres designated as "mitigation area" on the attached mitigation plan, shown on the attachment entitled "Louisiana Conservation Servitude" in accordance with the Louisiana Conservation Servitude Act (R.S. 9:1271 et seq.). The draft conservation servitude shall be sent to this office for approval within 30 days of permit issuance. Upon approval, the conservation servitude shall be filed in the real property records of St. Mary Parish prior to initiation of work authorized by this permit. A copy of the executed and recorded document must then be sent to the Corps of Engineers, Regulatory Branch within 90 days of the date it was recorded.

9. As additional compensatory mitigation, the permittee has agreed to contract with Louisiana Wetlands, L.L.C. (LW) for the restoration of bottomland hardwoods on 32 acres of abandoned agricultural land managed and operated in accordance with the Bayou Teche Wetlands Mitigation Area Agreement dated January 28, 1998. The contract shall stipulate that the plantings will be conducted during the non-growing season beginning December 15, 2002. Once the contract has been executed, the responsibility to complete the compensatory mitigation requirements of this permit becomes that of LW as per the agreement.

10. The permittee shall provide the Corps of Engineers, Regulatory Branch with written verification from LW that the financial arrangements needed to perform the initial plantings have been made. This verification shall be provided by August 1 following permit issuance or prior to commencement of the work authorized in this permit, whichever comes first.

11. The compensatory mitigation identified above has been determined to be a necessary part of this permit approval. Failure by the permittee to perform the compensatory mitigation, in accordance with the permit conditions, is considered grounds for permit suspension, permit revocation and/or restoration of the work performed under this authorization.



**PROPOSED
HORIZONTAL EXPANSION**

VICINITY MAP

REPRODUCED FROM LA. DOTD MAP OF ST. MARY PARISH



411 Wall Street
Lafayette, LA 70506-3096

PENSICO
PROFESSIONAL ENGINEERING AND SURVEYING CO., INC.

Turner Environmental, Inc.

Consulting Engineers & Scientists

**SOLID WASTE DISPOSAL FACILITIES
HORIZONTAL EXPANSION**

SECTIONS 4, 9, & 11, T16S- R12E
ST. MARY PARISH, LOUISIANA

JOB NO.: PW001-132

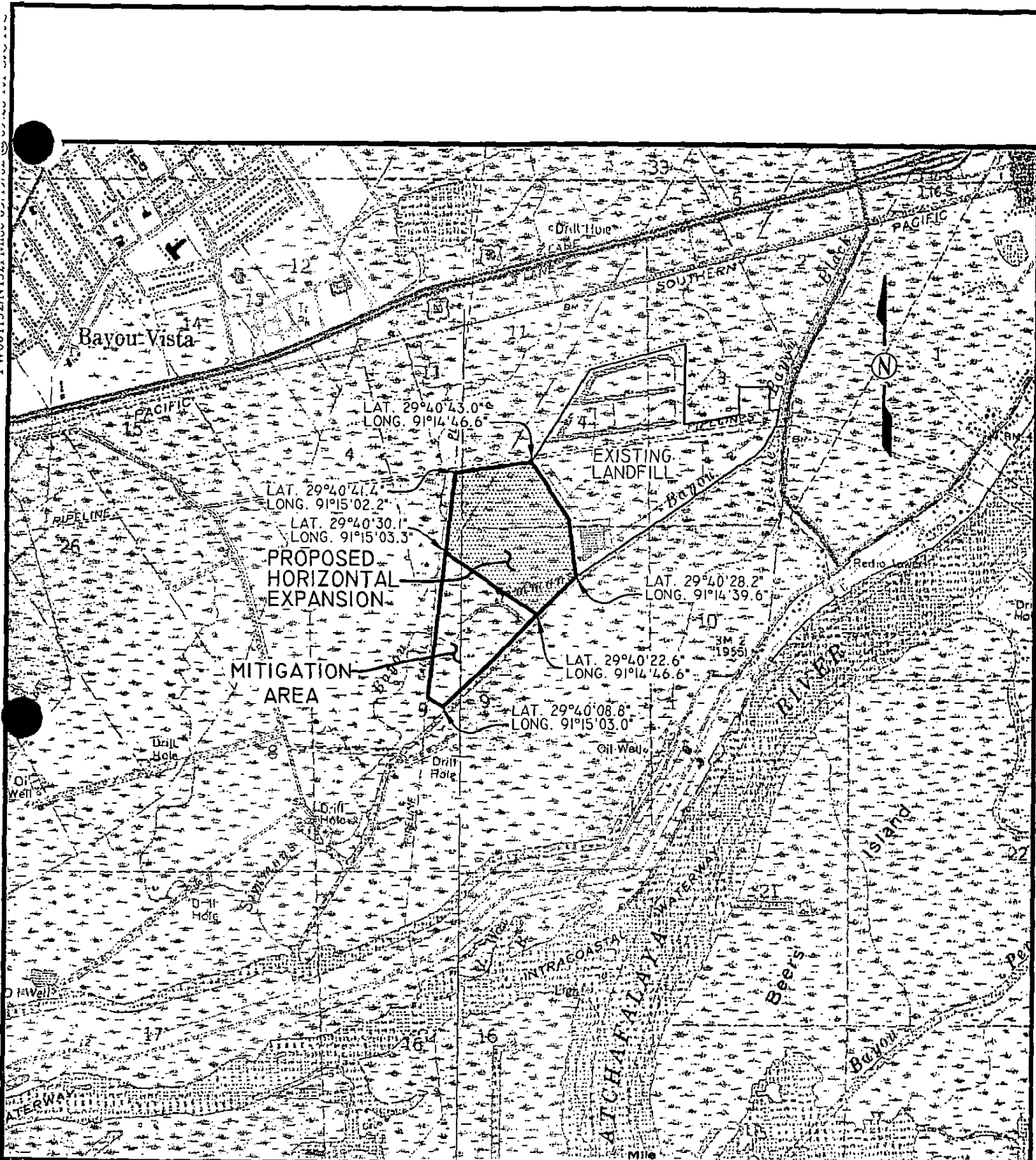
DATE: SEPT., '02

DRAWN BY: TJP

CHECKED BY: PAH

SHEET NO.

1 OF 6



LOCATION MAP

REPRODUCED FROM USGS "MORGAN CITY" QUADRANGLE



411 Wall Street
Lafayette, LA 70506-3096

PENSCO

PROFESSIONAL ENGINEERING AND SURVEYING CO., INC.

Turner Environmental, Inc.

Consulting Engineers & Scientists

SOLID WASTE DISPOSAL FACILITIES HORIZONTAL EXPANSION

SECTIONS 4, 9, & 11, T16S-R12E
ST. MARY PARISH, LOUISIANA

JOB NO.: PW001-132

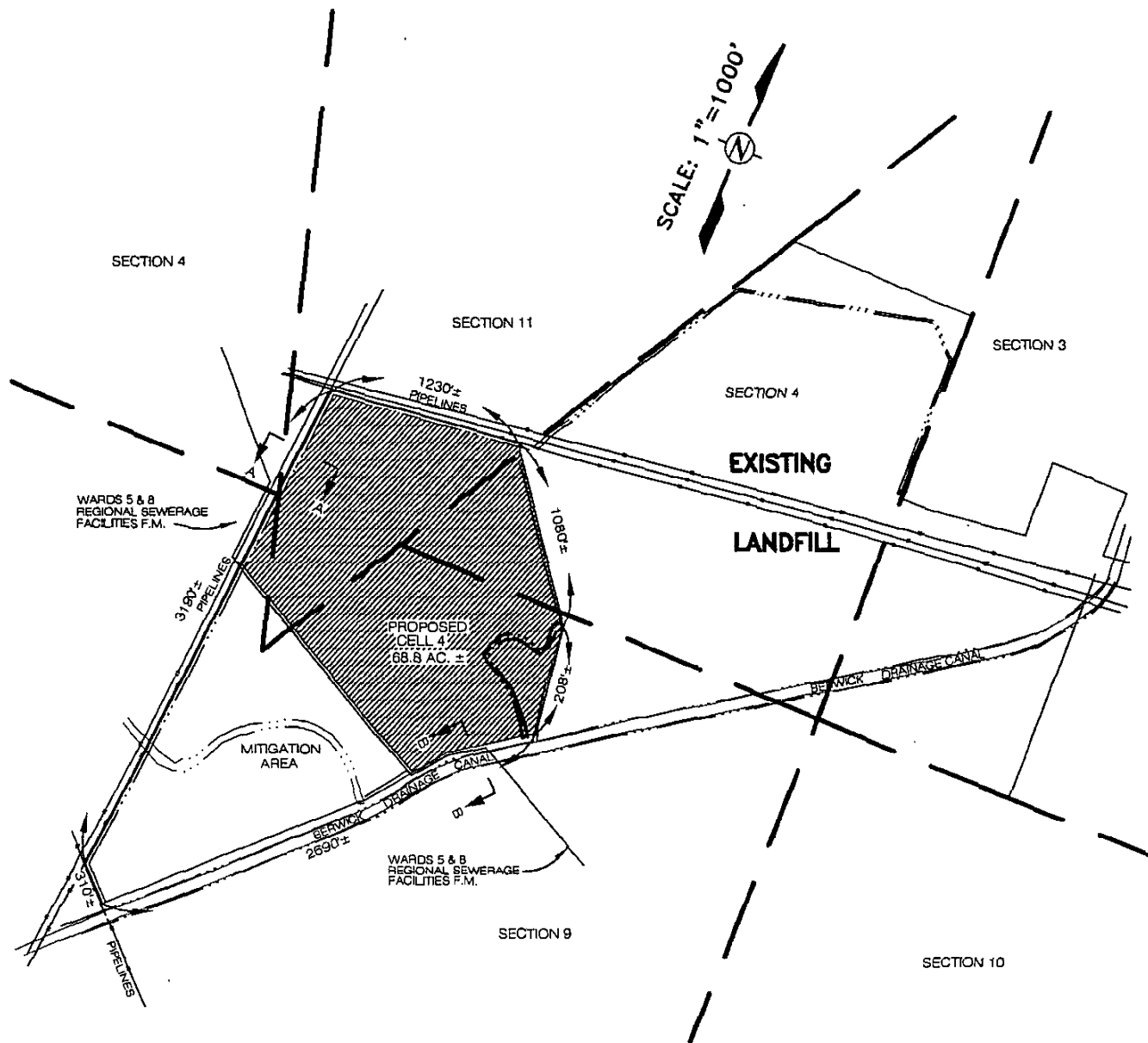
DATE: SEPT., '02

DRAWN BY: TJP

CHECKED BY: PAH

SHEET NO.

2 OF 6



LAYOUT MAP



411 Wall Street
Lafayette, LA 70506-3096

PROFESSIONAL ENGINEERING AND SURVEYING CO., INC.

Turner Environmental, Inc.
Consulting Engineers & Scientists

SOLID WASTE DISPOSAL FACILITIES HORIZONTAL EXPANSION

SECTIONS 4, 9, & 11, T16S- R12E
ST. MARY PARISH, LOUISIANA

JOB NO.: PW001-132

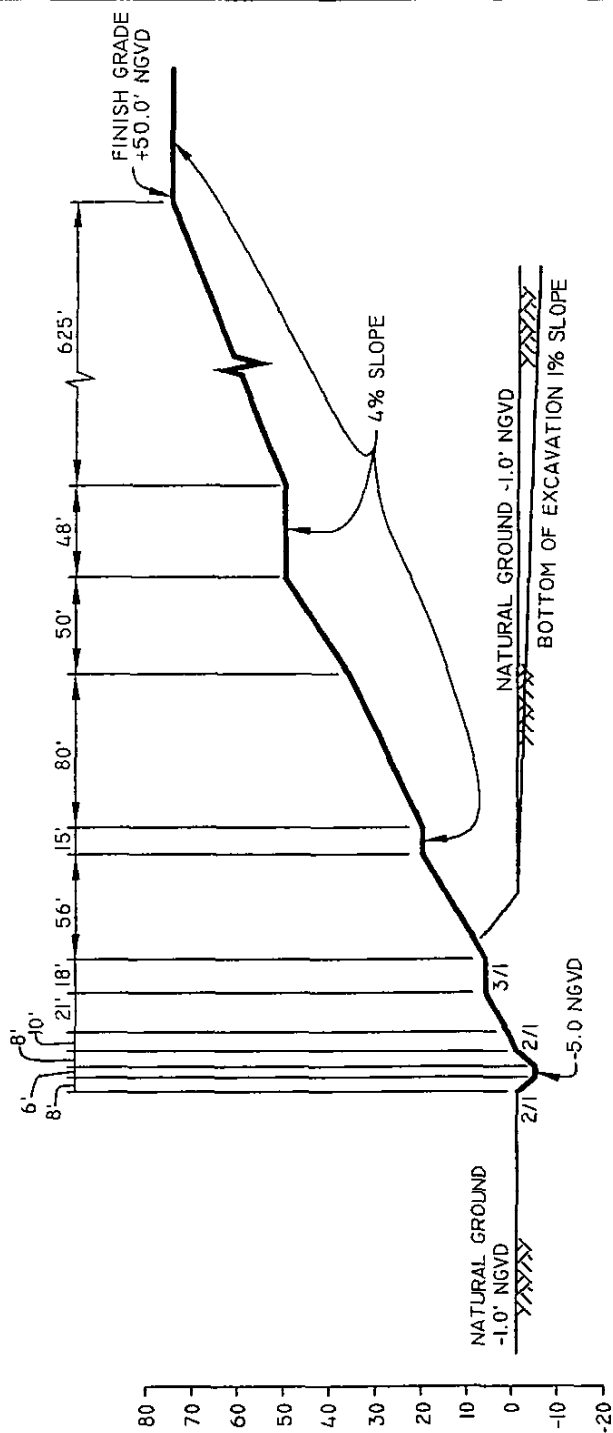
DATE: SEPT., '02

DRAWN BY: SJO

CHECKED BY: PAH

SHEET NO.

3 OF 6



SECTION A-A
1"=100' HORZ. 1"=40' VERT.

TYPICAL CROSS-SECTION



411 Wall Street
Lafayette, LA 70506-3096

PENSICO
PROFESSIONAL ENGINEERING AND SURVEYING CO., INC.

Turner Environmental, Inc.

Consulting Engineers & Scientists

SOLID WASTE DISPOSAL FACILITIES HORIZONTAL EXPANSION

SECTIONS 4, 9, & 11, T16S-R12E
ST. MARY PARISH, LOUISIANA

JOB NO.: PW001-132

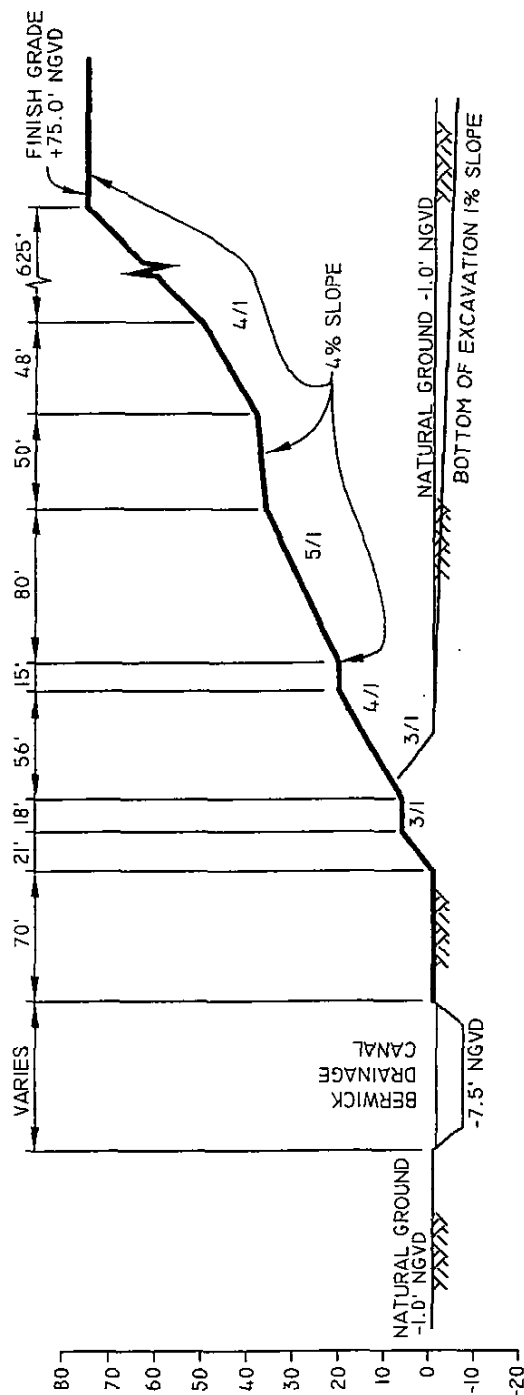
DATE: SEPT., '02

DRAWN BY: TJP

CHECKED BY: PAH

SHEET NO.

4 OF 6



SECTION B-B

1"=100' HORZ. 1"=40' VERT.

TYPICAL CROSS-SECTION



411 Wall Street
Lafayette, LA 70506-3096

PENSICO
PROFESSIONAL ENGINEERING AND SURVEYING CO., INC.

Turner Environmental, Inc.
Consulting Engineers & Scientists

SOLID WASTE DISPOSAL FACILITIES HORIZONTAL EXPANSION

SECTIONS 4, 9, & 11, T16S-R12E
ST. MARY PARISH, LOUISIANA

JOB NO.: PW001-132

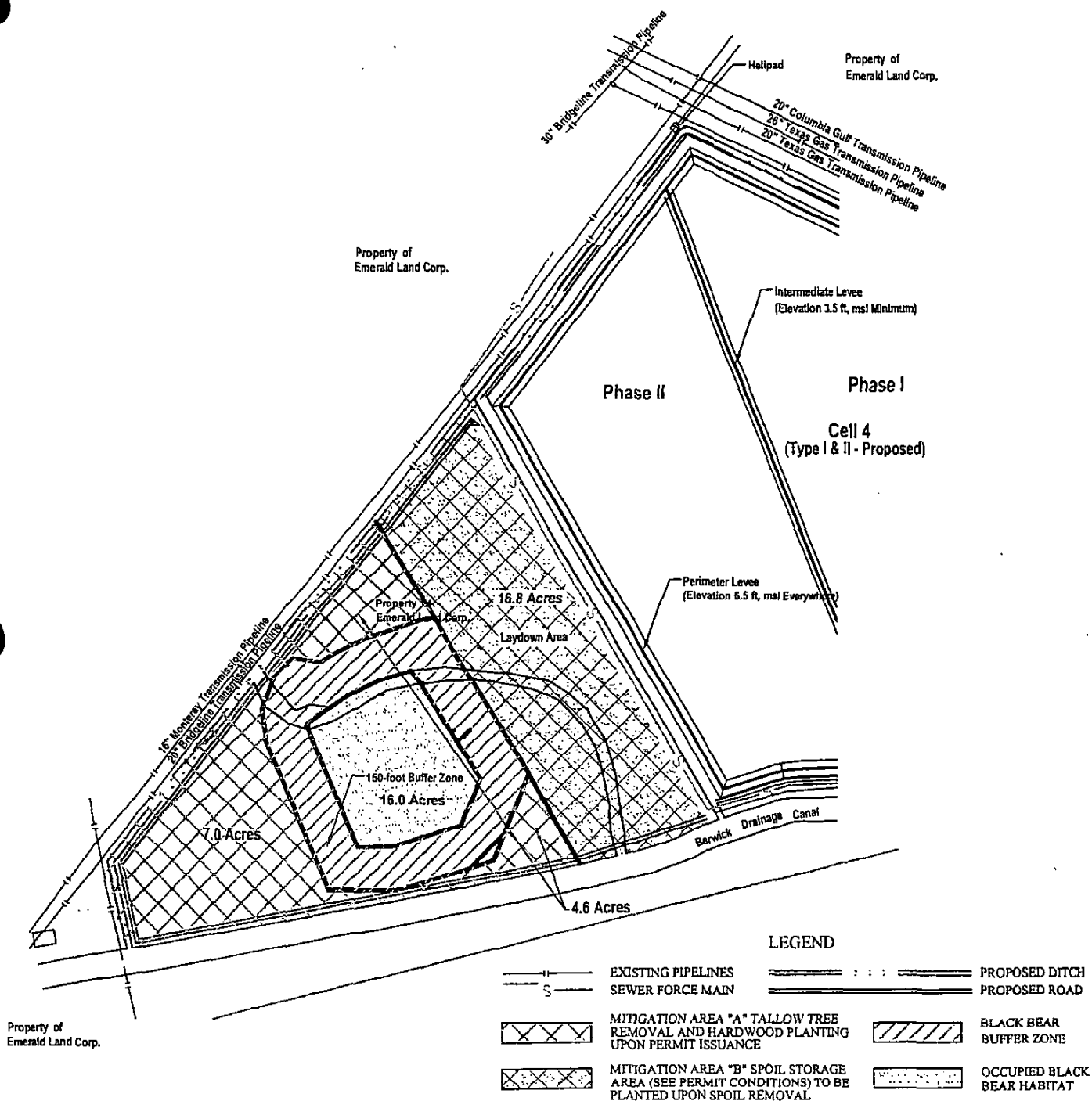
DATE: SEPT., '02

DRAWN BY: TJP

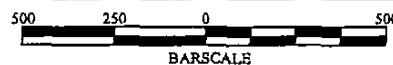
CHECKED BY: PAH

SHEET NO.

5 OF 6



MITIGATION PLAN



411 Wall Street
Lafayette, LA 70506-3096

PROFESSIONAL ENGINEERING AND SURVEYING CO., INC.

Turner Environmental, Inc.

Consulting Engineers & Scientists

SOLID WASTE DISPOSAL FACILITIES HORIZONTAL EXPANSION

SECTIONS 4, 9, & 11, T16S-R12E
ST. MARY PARISH, LOUISIANA

JOB NO.: PW001-132

DATE: SEPT., '02

DRAWN BY: TJP

CHECKED BY: PAH

SHEET NO.

6 OF 6

Exhibit 31
LDWF Letter of Approbation

State of Louisiana



James H. Jenkins, Jr.
Secretary

Department of Wildlife & Fisheries
Post Office Box 98000
Baton Rouge, LA 70898-9000
(225) 765-2300

M.J. "Mike" Foster, Jr.
Governor

August 29, 2000

Mr. Patrick W. Forbes, PE
Project Manager

Turner Environmental, Inc.
7918 Wrenwood Blvd., Suite C
Baton Rouge, LA 70809

RE: St. Mary Parish Landfill Expansion

Dear Mr. Forbes:

Personnel of the Louisiana Department of Wildlife and Fisheries have reviewed the basic information and map provided to us relative to the above referenced project.

Please be advised that the proposed expansion encroaches on occupied habitat of the Louisiana Black Bear. The Louisiana Black Bear is a listed Threatened species. Consideration of the potential for the occurrence of, and impact on this species in your area must be an integral part of the planning and design of the proposed expansion.

No other, threatened or endangered species are known to be in the project vicinity. No wildlife management areas will be impacted, nor will any designated Natural and Scenic River.

Thank you for requesting our comments at this time.

Sincerely,

Philip E. Bowman
Asst. Secretary, Office of Wildlife.

Exhibit 32
LDCRT Letter of Approbation

TURNER ENVIRONMENTAL, INC.

Consulting Engineers and Scientists

7918 Wrenwood Blvd., Suite C
 Baton Rouge, Louisiana 70809
 225 926 4300 Tel
 225 926 4360 Fax
 www.teius.com

August 17, 2000

State of Louisiana
 Department of Culture, Recreation and Tourism
 Office of Cultural Development
 P.O. Box 44307
 Baton Rouge, LA 70804

RE: Harold J. "Babe" Landry Landfill, St. Mary Parish

Date: 11-8-00

No known archaeological sites or historic properties will be affected by this undertaking. This effect determination could change should new information come to our attention.

Gerri Hobbs
 State Historic Preservation Officer

Dear Sir or Madam:

Turner Environmental, Inc., on behalf of the Government of St. Mary Parish, requests a letter of consent for the referenced project. The Government of St. Mary Parish intends to renew their existing solid waste permit with the Louisiana Department of Environmental Quality (LaDEQ) for the Harold J. "Babe" Landry landfill, Berwick, Louisiana. The attached figure shows the location of the landfill.

As part of the permit renewal, the Government of St. Mary Parish is required to submit a permit application to the LaDEQ. One requirement of the permit application is a letter from the Louisiana Department of Culture, Recreation and Tourism stating that there are no known archaeological or historical sites located within 1000' of the facility.

As you can see on the figure, the facility lies approximately 1.5 miles southwest of the town of Berwick, LA. The landfill has existed on the property since 1979 and has been permitted by the State of Louisiana since 1988. The proposed renewal involves a lateral expansion of the facility with the addition of Cell 4, which is delineated on the attached figure. Please review the proposed project with regard to your archaeological and historical information on this area and provide a letter either stating that the referenced Type II landfill is not within 1000' of any known archaeological or historical sites, or listing any such sites.

Your attention in this matter is greatly appreciated. Should you have any questions on this matter, please do not hesitate to contact us.

Very truly yours,
 TURNER ENVIRONMENTAL, INC.

Patrick W. Forbes, PE
 Project Engineer

PWF
 Attachments

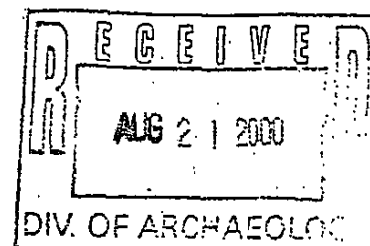


Exhibit 33
LDNR Coastal Use Permit Exemption



J. "MIKE" FOSTER, JR.
GOVERNOR

JACK C. CALDWELL
SECRETARY

DEPARTMENT OF NATURAL RESOURCES

July 27, 2000

PENSCO
Attn: P. A. Hoppe
411 Wall Street
Lafayette, LA 70506

RE: P000981; Coastal Use Permit Application for the proposed expansion of the St. Mary Parish Government Solid Waste Disposal Facility. Approx. 110 acres of vegetation will be cleared during the construction of cells 4 and 5. A berm will be constructed along the perimeter of the expansion area. The area within the berm will be excavated 5' below normal ground, lined with geosynthetics, and filled with solid waste. Site location: Lat. 29°40'28.2"N, Long. 91°14'39.6"W, Sections 4, 9, & 11, T16S-R12E, St. Mary Parish, LA.

Dear Mr. Hoppe:

A review has been completed of the referenced application. In accordance with the Rules and Procedures for Coastal Use Permits, Title 43, Subpart 723-B.2, the proposed activity is exempt and a Coastal Use Permit is not required.

This determination is valid for two (2) years from the date of this letter. If the proposed activity is not initiated within this two year period, this determination will expire and the applicant will be required to submit a new application. The applicant will notify the Coastal Management Division of the date on which initiation of the proposed activity began by mailing the enclosed green initiation card on the date of initiation of the proposed activity. This authorization does not eliminate the need to obtain a permit from the United States Army, Corps of Engineers or any other Federal, state, or local approval, that may be required by law.

The drawings submitted with your referenced application are attached hereto and made a part of the record.

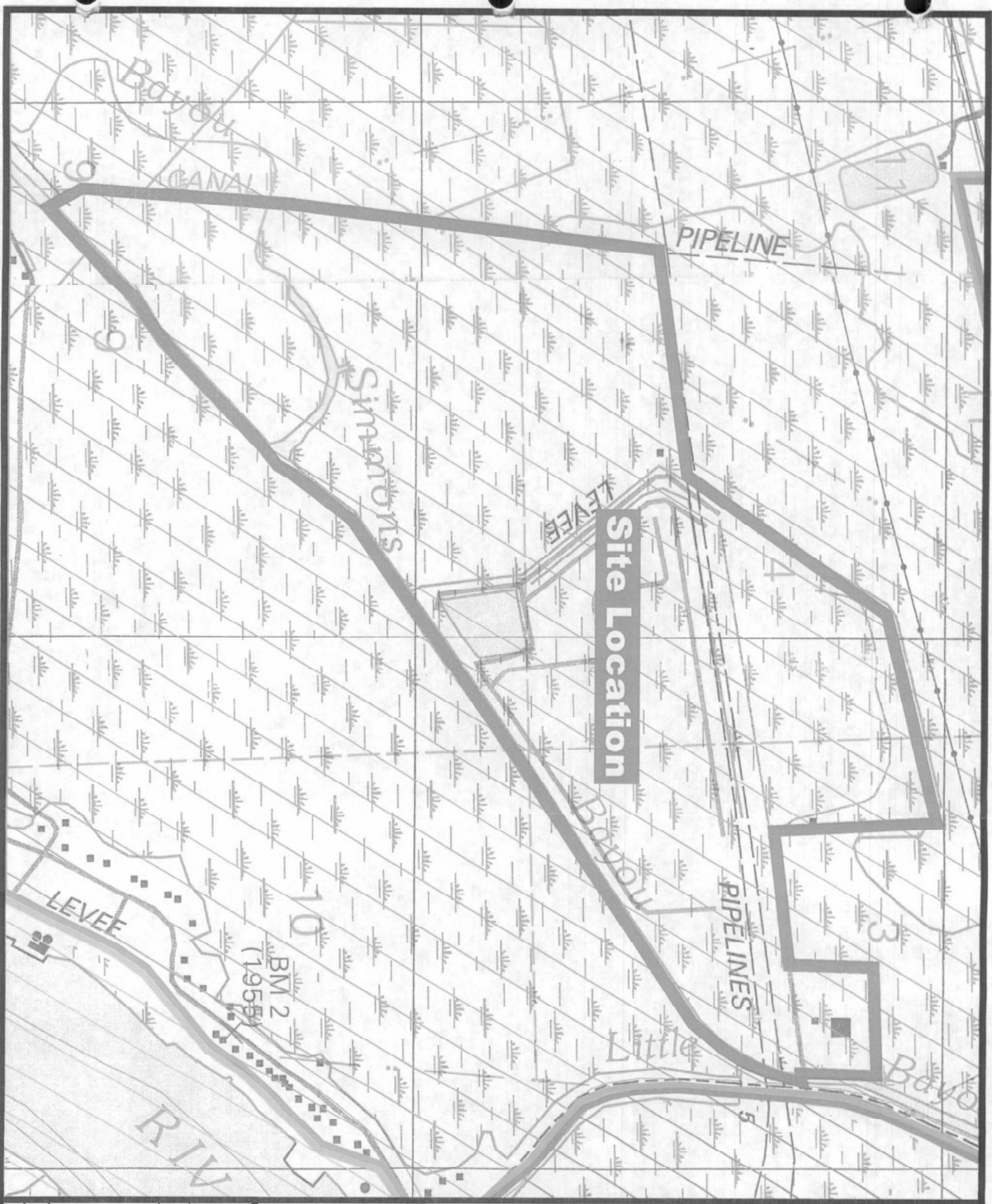
Sincerely,

Terry Howey
Terry Howey, Administrator
Coastal Management Division




TH/cd

cc: Ron Ventola, COE w/plats
Fred Dunham, LDWF w/plats
Charles Mestayer, CMD/FI w/plats
Karl Morgan, CMD w/plats
Carol Vinning, St. Mary Parish w/plats
George Robichaux, DHH w/plats

Exhibit 34
Flood Zone Map



Legend

-  Flood Elevation of 1.5 Feet. (Flood elevation is based on effects from local rainfall because the area is within a ring levee system.)
-  Flood Elevation of 10 Feet. (Flood elevation is based on effects from local rainfall because the area is within a ring levee system.)
-  Flood Elevation of 100 Feet.
-  Site Boundary

Note:

Flood elevations are based on 100 year flood events.

Reference:

Base map comprised of U.S.G.S. 7.5 minute topographic maps titled Morgan City, Louisiana, and Patterson, Louisiana, dated 1994. Flood zone data obtained from National Flood Insurance Program's FIRM (Flood Insurance Rate Map of St. Mary Parish, Louisiana dated 1995) and Town of Berwick, Louisiana dated 1995.



Figure 4
Flood Zone Map
Herald J. Baber Landry Landfill - Berwick, Louisiana
Solid Waste Standard Permit Renewal Application
St. Mary Parish Government
Franklin, Louisiana



			
Date	11/26/01	Checked By:	TSS
Drawn By:	TEINAH	Approved By:	WTT
Job No.:	PEN-001	Drawing No.:	PEN-001-04

Exhibit 36
LRRDA Letter of Approbation



State of Louisiana

Department of Environmental Quality



M.J. "MIKE" FOSTER, JR.
GOVERNOR

J. DALE GIVENS
SECRETARY

August 29, 2000

Turner Environmental, Inc.

Patrick W. Forbes PE

7918 Wrenwood Boulevard

Suite C

Baton Rouge, Louisiana 70809

Re: Harold J. "Babe" Landry Landfill

Type I, II and III Landfill

St. Mary Parish

Dear Mr. Sharma:

The above-referenced facility does not conflict with any plans or proposed facilities of the Louisiana Resource Recovery and Development Authority (LRRDA), as of this date.

If you have any questions concerning this matter, please contact me at (318) 898-4206.

Sincerely,

R. Brady Broussard
Chairman, LRRDA

RBB:tle



recycled paper

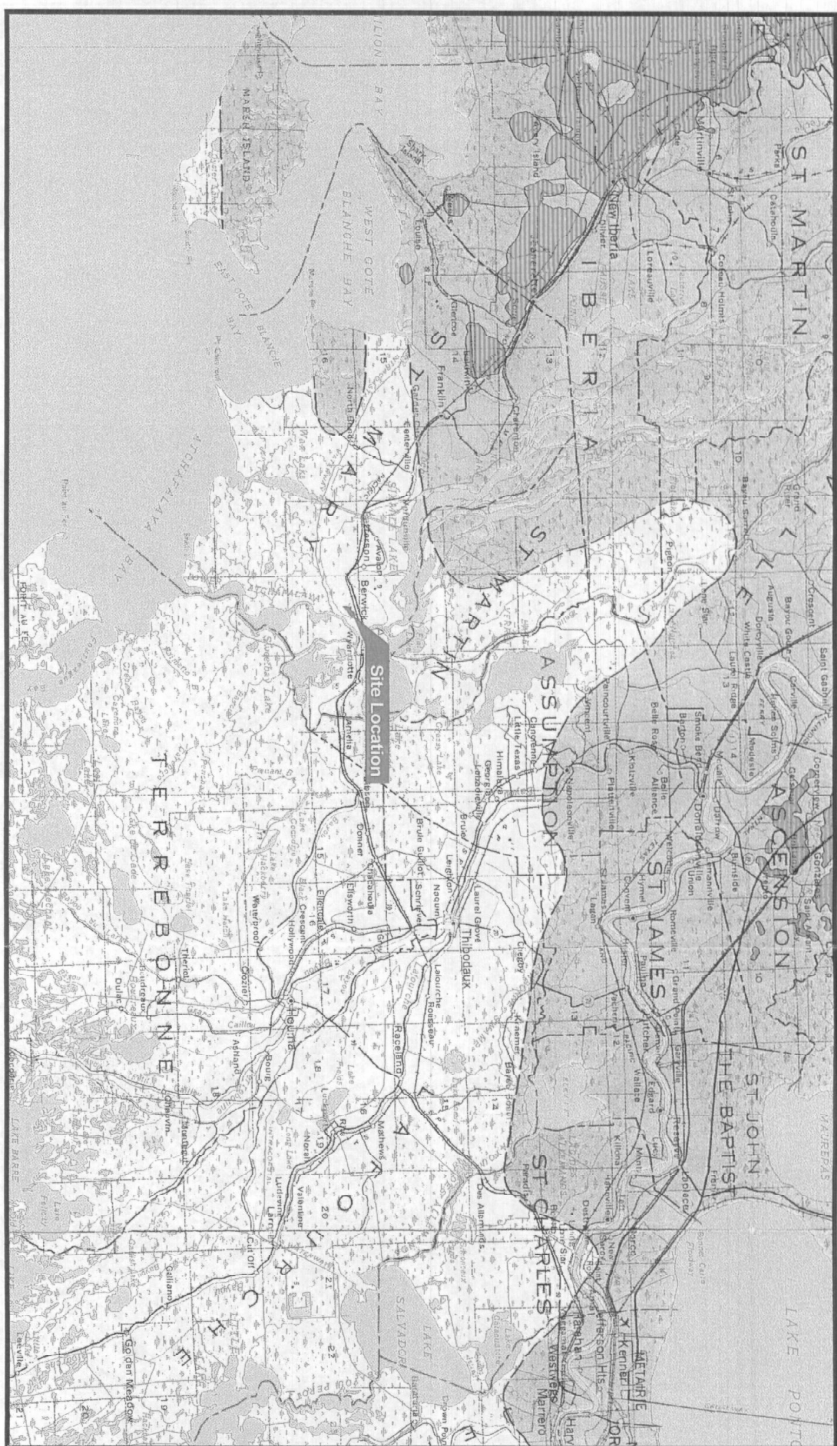
OFFICE OF ENVIRONMENTAL SERVICES • P.O. BOX 82135 • BATON ROUGE, LOUISIANA 70884-2135

AN EQUAL OPPORTUNITY EMPLOYER



FIGURES

Exhibit 35
Aquifer Recharge Area Map



KEY TO RECHARGE POTENTIAL

AQUIFER RECHARGE POTENTIAL for each soil association within a watershed is determined based on such soil characteristics as parent material, geologic rock type, permeability and drainage, surface slope, and surface runoff. These characteristics affect the movement of water from the surface, through the soil horizon, and into the underlying geochronologic systems. These interpretations are based on the soil characteristics up to six feet below the surface.

HIGH RECHARGE POTENTIAL areas generally consist of deep, well- to excessively drained sands and gravels with rapid rates of infiltration and subsoil permeability and low runoff potential.

MODERATE RECHARGE POTENTIAL areas generally consist of moderately to well-drained soils having medium texture and moderate rates of water transmission. They include some soil associations having areas of both high and low recharge characteristics.

LOW RECHARGE POTENTIAL means generally consist of poorly drained silt and clays with slow to very slow infiltration and permeability rates and high runoff potential. They include shallow soils over nearly impervious materials and soils with a claypan or a thick clay layer at or near the surface.

Areas that do not recharge major Louisiana freshwater aquifers.

Southern limit of
freshwater aquifer

Reference

Base comprised of map titled "Recharge Potential of Louisiana Aquifers" prepared for the Louisiana Department of Environmental Quality by the Louisiana Geological Survey funded by the U.S. Environmental Protection Agency dated 1988 2nd printing 1991.

Figure 10

Aquifer Recharge Area Map

Ronald J. "Boe" Landry Landfill - Berwick, Louisiana
Solid Waste Standard Permit Renewal Application

St. Mary Parish Government

Franklin, Louisiana



PENSCO



**TURNER
ENVIRONMENTAL**

Date: _____

12/05/00b

Check

ed:

LWVF

1

Jc

No.:

1

APPENDICES

Appendix B

Facility Operations Plan

Wastes to be specifically excluded from disposal at the landfill include the following:

- Hazardous Wastes;
- Containers holding liquid waste, unless the container is a small container similar to that normally found in household waste, designed to hold liquids for use other than storage, or the waste is household waste.
- Liquid Wastes (unless properly solidified or the waste is household waste, other than septic waste);
- Regulated Hospital Wastes;
- PCBs;
- White Goods; and
- Whole Waste Tires.

All of the above listed wastes are as defined in LAC 33:V and VII. St. Mary Parish estimates that a maximum of approximately 120,000 tons per year of waste will be received at the landfill.

9.0 CONTINGENCIES

9.1 WEATHER

The following operational procedures apply in the event of adverse weather conditions. The facility's roads have all been constructed to meet all-weather requirements (i.e., either paved or aggregate). Similarly, all of the waste working equipment identified in Section 6.4 is equipped with protective covers to prevent exposure to the elements. As such, normal rainfall events will not affect operations at the facility.

For short term and/or sudden severe weather (e.g., tornado warnings, high winds, severe thunderstorms, severe lightning, etc.), landfilling operations will be temporarily halted at the direction of the Landfill Supervisor and/or Operations Superintendent with the approval of the St. Mary Parish Chief Administrative Officer (CAO). Loose items, which can be moved by wind or otherwise damaged, will be secured or protected. Personnel and any visitors will be asked to take shelter in the on-site buildings. Once weather conditions improve, the Landfill Supervisor and/or Operations Superintendent will direct that work is to resume. St. Mary Parish Landfill personnel will notify LDEQ if operating hours are temporarily extended to accommodate increased waste intake quantities after these events.

In the case of longer term adverse weather, which may be predicted (e.g., hurricanes and severe frontal systems), the Landfill Supervisor may suspend landfilling activities for several days. Personnel will be directed to secure the facility, including covering of the working face and setting of pumps. St. Mary Parish Landfill personnel will notify LDEQ if operating hours are temporarily extended to accommodate increased waste intake quantities after these events.

Periods of extended and/or heavy rain may require suspension of landfilling activity in order to focus on management of water as discussed in Section 7.0. The decision to suspend landfilling will be made by the Landfill Supervisor.

9.2 BREAKDOWN

Breakdown of particular pieces of mobile landfilling equipment may cause interruption of landfilling activity. However, for the equipment listed, no single piece is essential. Rather, practices are modified to accommodate the out-of-service equipment. For example, if the compactor is broken, then the dozer may be used to compact and spread waste; that being done in thinner lifts.

The broken piece of mobile equipment will be moved from the area of the working face and repaired. An evaluation of the scope of repair will be made first. If the evaluation indicates loss of service for a period of days, then the Landfill Supervisor, with the advice of the Operations Superintendent, will make a decision regarding rental of a replacement.

Appendix D
Industrial Waste Acceptance
Quality Assurance/Quality Control Plan

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Exhibits

Exhibit 1	Industrial Waste Profile Form
Exhibit 2	Generator's Certification of Representative Sample
Exhibit 3	Special Waste Management Decision Form
Exhibit 4	Non-Hazardous Industrial Waste Manifest
Exhibit 5	Site Access Plan

1.5 SERVICE AREA

Wastes will be accepted only if the origin of the waste is within the landfill service area. The landfill service area for Industrial Waste includes the following parishes:

- St. Mary
- Assumption
- Iberia
- St. Martin
- Terrebonne

The primary service area is St. Mary Parish. The other four parishes adjoin St. Mary Parish and constitute the secondary service area.

1.6 PRE-ACCEPTANCE PROCEDURES

Procedures set forth herein will be utilized to assure that:

- All hazardous wastes (as defined by the LDEQ and U.S. EPA) and wastes containing free liquids are excluded from this landfill; and
- To determine the acceptability of a given waste for receipt at the facility.

Pre-acceptance requirements specify the information a potential customer must provide to the Landfill Supervisor so that a determination can be made as to the acceptability of a waste for disposal. The pre-acceptance procedure is the mechanism for deciding to reject or accept a particular waste, prior to its shipment to the facility. The decision to accept or reject a waste is based on:

- The provisions of the landfill permit;
- The compatibility of the waste proposed for disposal with other wastes;
- The compatibility of the waste proposed for disposal with the landfill materials of construction; and
- The availability of landfill personnel and capacity to provide disposal of the waste without impairment of the ability to provide disposal for municipal waste.

All wastes must, at a minimum, be specifically approved in writing by the Landfill Supervisor.

Sample documentation utilized during the approval process is attached. In order to provide flexibility to meet new regulations or Parish policies, revisions to these forms may be necessary. However, the information contained in the attached forms is considered typical and will be obtained, recorded and kept on file at the facility.

Certain sludges with no free liquids may be mixed within the landfill cell to achieve a suitable consistency. In such cases, the following disposal plan will be followed:

1. Pre-approved non-hazardous sludges will arrive at the landfill in covered vehicles. The transporter may be required to contact the landfill to determine the date(s), time(s), and volume of sludge to be accepted. This will be done to insure that adequate refuse will be available for bulking as well as for proper planning of a day's activities.
2. In order to insure proper mixing of the sludge with the refuse and to maintain the proper ratio of refuse to sludge, the sludge will not be placed as the first or the last waste of the day's operation. The exact bulking ratio will be determined on a stream specific basis.
3. Once the "sludge" arrives at the working face, it will be introduced into the landfill in a manner that will achieve maximum mixing and distribution throughout the waste pile so as to take full advantage of the available absorptive capacity of the refuse. This requirement makes it necessary for the sludge to be metered into the site and incorporated at a rate that will not affect equipment or vehicle mobility.
4. The working face will not be allowed to become "soupy" due to the disposal of sludge. Commingling will be accomplished by spreading the sludge and refuse in alternating layers and compacting the mass down and into the working face. Odor will be minimized through the normal operation of the site.
5. Sludge will not be utilized as daily cover, nor be incorporated in the final cover without prior LDEQ approval.

It will be possible to determine the location of the sludge through the use of the Landfill Supervisor's daily log, which references the site plan and lift elevation, and daily record of receipts, trucks, types of waste, etc. The exact bulking ratio will be determined on a stream-specific basis.

2.7 SEPARATE DISPOSAL AREA

Solid wastes that are determined by the Parish to require disposal without mixing with other types of waste will be disposed in a separate working area. Plans and details for these special areas will be submitted to the LDEQ for review prior to accepting any such waste.

One or more of these areas may be used for disposal of wastes found to be incompatible with other wastes or standard site disposal methods. It is foreseeable that in the future some generators may require separate disposal areas for their own waste(s). Such a disposal area would be regulated by this QA/QC plan in the same manner as non-segregated wastes. See Section 3.0 for disposal of RACM waste.

2.8 RE-APPROVAL PROCESS

All industrial wastes, once approved, will require periodic re-approval including an analysis. The frequency of re-analysis will be determined on a stream specific basis in accordance with §711.D.3.d. The re-approval

3.0 RACM WASTE

3.1 INTRODUCTION

The following requirements and procedures will be followed while managing regulated asbestos-containing material (RACM) waste. The primary health consideration in handling RACM waste is preventing the release of asbestos containing dust into the air.

3.2 WASTE APPROVAL AND RECORDKEEPING

Each RACM waste stream will be subjected to the special waste approval process and to special record keeping requirements.

1. Asbestos Disposal Verification Form (ADVF)

All RACM waste transporters will be required to submit a State of Louisiana Asbestos Disposal Verification Form (ADVF) upon delivery of friable asbestos waste to the landfill. The ADVF is to be completed by the generator and transporter and then sent with the driver of each load. The Landfill Manager will then complete the destination section and give one copy to the driver. A second copy will be sent to the generator to verify final destination, and a third copy of the ADVF will be sent to LDEQ (Office of Environmental Services, Air Permits Division) within 30 days of final disposition. The fourth copy will be made a permanent part of the St. Mary Parish Landfill records. No RACM waste will be accepted without an ADVF.

The ADVF shall contain the following information:

- a. Name, address, and telephone number of the RACM waste generator;
- b. Name, address, and telephone number of the transporter(s);
- c. The quantity of RACM waste in cubic yards;
- d. The presence of improperly enclosed or uncovered waste, or any RACM waste not sealed in leak-tight containers;
 - i. A written report of such an event, along with the ADVF, will be sent to the administrative authority (as identified on the ADVF) by the following workday.
- e. The date of receipt.

2. Waste Discrepancy/Rejected Load Report

RACM waste will not be accepted and a Waste Discrepancy/Rejected Load Report (Exhibit 3 - Special Waste Management Decision form) will be completed when any of the following occur:

- a. RACM waste arrives without an ADVF;
- b. RACM waste arrives and the waste material does not match the description or quantity on the ADVF;

- c. RACM waste arrives, and the information on the ADVF is incomplete or incorrect.

This report will then be made a permanent part of the St. Mary Parish Landfill records. If such discrepancies can be resolved between the Landfill Manager and the Generator, then the waste can be accepted. Otherwise, a copy of the report and ADVF will be forwarded to the Generator and to the LDEQ (Office of Environmental Services, Air Permits Division) within 15 days after receiving the waste.

3. Record Maintenance

- a. All records, logs, and forms regarding RACM waste will be maintained for at least two years in the landfill office.
- b. The grid coordinates, depth (elevation), quantity (cubic yards), and site map marked with location shall be maintained for all RACM waste in the landfill office until closure of the facility.
- c. A copy of all records of RACM waste disposal locations and quantities will be submitted to LDEQ (Office of Environmental Services, Air Permits Division) upon closure of the facility.
- d. Within 60 days of closure and in accordance with State law, a notation will be attached in perpetuity to the deed of the facility property and on any other instrument that would normally be examined during a title search stating that:
 - i. The land has been used for disposal of RACM waste;
 - ii. The survey plot and record of the location and quantity of RACM waste disposed of at the facility; and
 - iii. The site is subject to LAC 33:III.Chapter 51.Subchapter M and the certification provisions in LAC 33:III.2799.Appendix A – Agent Accreditation Plan.

3.3 PACKAGING

RACM waste will be accepted only when it is in wetted conditions and after it has been placed in closed, unruptured 6 mil minimum polyethylene double bags or in other tightly closed containers. If bagged, the bags shall be "goose-necked" and double tied. Individual bags must be of a weight and size that can be easily handled by the transporter. All RACM waste containers must be pre-approved by the Landfill Manager prior to disposal at the St. Mary Parish Landfill.

Each bag or container which contains RACM waste must have the following warning and must be of a size no smaller than three by five inches (3 x 5):

<p style="text-align: center;">CAUTION – CONTAINS ASBESTOS. AVOID OPENING OR BREAKING CONTAINER. BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH.</p>

Alternatively, warning labels specified by Occupational Safety and Health Standards of the Department of Labor, Occupational Safety and Health Administration (OSHA) under 20 CFR 1910.93 a (g)(2)(ii) may be used.

3.4 OPERATIONS

The Landfill Manager will ensure all RACM waste is carefully dumped and unloaded, placed in the proper location (according to the assigned grid coordinates) and covered. RACM waste will only be accepted into Type I/II Cell 4. Deposition or temporary storage of RACM waste in any other area of the facility will be strictly prohibited. There shall be no visible emissions to the outside air from any active waste disposal area within the landfill where asbestos-containing waste material has been deposited.

The Landfill Manager will implement the contingency plan in the event of accidental spills. The following minimum guidelines will always be adhered to:

1. Delivery of RACM waste will be coordinated with the Landfill Manager so that the waste arrives at the landfill at a specific time that will facilitate adequate personnel and equipment to immediately handle, dispose of, and cover the waste.
2. The disposal area will be away from non-essential personnel. The disposal area will be an excavation, depression in the working face, or at the toe of the slope.
3. The area will be large enough to contain the entire load and required cover material.
4. The driver should approach the disposal location as closely as possible for unloading of the waste materials. Bags should then be taken out of secondary containers (e.g., drums) along with any other waste components. They should be inspected as they are off-loaded. In the event a bag has been damaged, the material should be repacked in another bag as appropriate.
5. The generator (and/or transporter) will be responsible for all transportation and unloading and must certify all containers and loads are in compliance with all regulatory requirements. The material will be carefully unloaded and placed in the final disposal area. A responsible landfill employee must be present during unloading operations. Care will be taken not to rupture any bags or containers.
6. Immediately after the generator/transporter's vehicle is moved away from the disposal area, the waste will be covered in accordance with the requirements of LAC 33:III.5151.N.3. Cover material will be applied prior to compacting the waste so as not to rupture the containers or disturb the waste.
7. RACM waste will not be placed within 15 feet of final grade (or slope) or within 15 feet of intermediate grade slope. Intermediate grade is defined as an area that will be exposed more than three months.
8. In the event of a spill (ruptured containers), the Landfill Manager will be notified immediately and will direct the collection and disposal of spilled material. Prior to the Landfill Manager's arrival, the area will be evacuated to the extent necessary to avoid breathing airborne friable asbestos fibers. Approved containers or bags will be readily available to collect spilled material. Spilled material may be wetted (to prevent dust) and placed in the disposal area. Care will be taken not to over-wet

the material to the point where it flows. All employees involved in spill cleanup will wear and use the required personal protection equipment.

9. The St. Mary Parish Landfill site plan will be used to locate the position of the waste within the site. The location, grid coordinates, depth (elevation), and quantity (cubic yards) where each load was disposed will be recorded in the waste receipt log and made a permanent part of the St. Mary Parish Landfill records.
10. LDEQ (Office of Environmental Services, Air Permits Division) will be notified in writing at least 45 days prior to excavating or otherwise disturbing any RACM waste that has been deposited within the landfill and covered. Notification will be provided in accordance with LAC 33:III.5151.N.10.
11. In accordance with LAC 33:VII.711.E.3.a, the Cell 4 final cover system will be constructed as follows, from bottom to top: 2 feet of compacted interim cover (where applicable); 12-inch sand gas collection layer; geosynthetic clay liner (GCL), with reinforcement on slopes and benches only; 60-mil LDPE geomembrane (smooth on crown and textured on benches); geocomposite drainage layer with 6-oz geotextile, both sides; and, 12 inches of topsoil with vegetation (seeded with grass).

3.5 PERSONNEL PROTECTION

1. Protection Equipment

Each St. Mary Parish Landfill employee who the Landfill Manager determines is likely to be exposed to RACM waste will be supplied with disposable clothing (coveralls and gloves) and respirator. Disposable coveralls will be worn over normal working attire.

St. Mary Parish Landfill asbestos management personnel will utilize NIOSH-approved asbestos protection full-face or half-face respirators with an approved filter (P100 or equivalent) during all RACM waste handling operations.

2. Personal Hygiene

After the RACM waste has been buried and prior to leaving the immediate work area, and before entering eating, smoking or drinking areas, all St. Mary Parish Landfill employees involved with disposing the RACM waste will remove disposable coveralls and gloves and seal them inside a plastic bag. The respirator will be the last piece of personal protective gear to be removed. Discarded coveralls and gloves will not be re-used. Respirators will be cleaned as per manufacturer's instructions and filters will be disposed of as required.

If asbestos is released, such as might happen if waste was not wetted or a container has burst open, disposable coveralls, gloves and respirators will be considered as potentially contaminated and therefore subject to applicable disposable requirements for other RACM wastes. Otherwise, sealed bags of disposable clothing and respirator filters will be promptly disposed of in the landfill.

As soon as possible after removal of personal protective gear, employees will wash their hands and face.

Uniforms worn under the disposable coveralls and other potentially contaminated clothing to be laundered will be sealed in a plastic bag.

3. Notification to Launderer

Launderers of uniforms will be notified of the potential that friable asbestos fibers may be present and that caution should be taken to prevent release of asbestos fibers.

4. Facial Hair (29 CFR 1910.134)

Anyone required to wear a respirator will obtain a good seal between the face and the respirator. Therefore, facial hair between the face and the sealing surface of the respirator, or hair that may interfere with the function of a respirator valve is not allowed. This includes beards, sideburns, long moustaches, low hairlines or bangs and stubble.

3.6 TRAINING AND INFORMING EMPLOYEES

1. Frequency

Employees will be trained prior to being assigned to RACM waste management duties and annually thereafter.

2. Content

Employees will receive training in the proper management of RACM waste, what it is, and its potential health effects if mismanaged. In addition, employees will be informed of the industrial hygiene monitoring, its purpose and meaning, and of their right of access to that information.

Included in the subject of proper management of RACM waste will be:

- a. standard operating procedures;
- b. local policies, procedures and regulations;
- c. proper use of personal protective equipment; and
- d. good personal hygiene practices.

All training will be documented.

3. Informing Employees

If monitoring is required and results of asbestos monitoring indicate that concentrations of asbestos fibers exceed the permissible exposure limit (PEL) in accordance with 29 CFR 1910.1001 (0.1 fiber per cubic centimeter of air as an eight hour time weighted average (TWA) as of July 1, 1999), personal monitoring results will be reported to affected employees within five (5) days of receipt of results.

3.7 EFFECT ON ENVIRONMENT AND OPERATION

The acceptance and disposal of RACM waste at the St. Mary Parish Landfill in accordance with above outlined special procedures, and in conjunction with the general procedures of this Quality Assurance and

Quality Control Plan, should not have an adverse affect on either the operation or the environment at the landfill.

3.8 SITE SECURITY

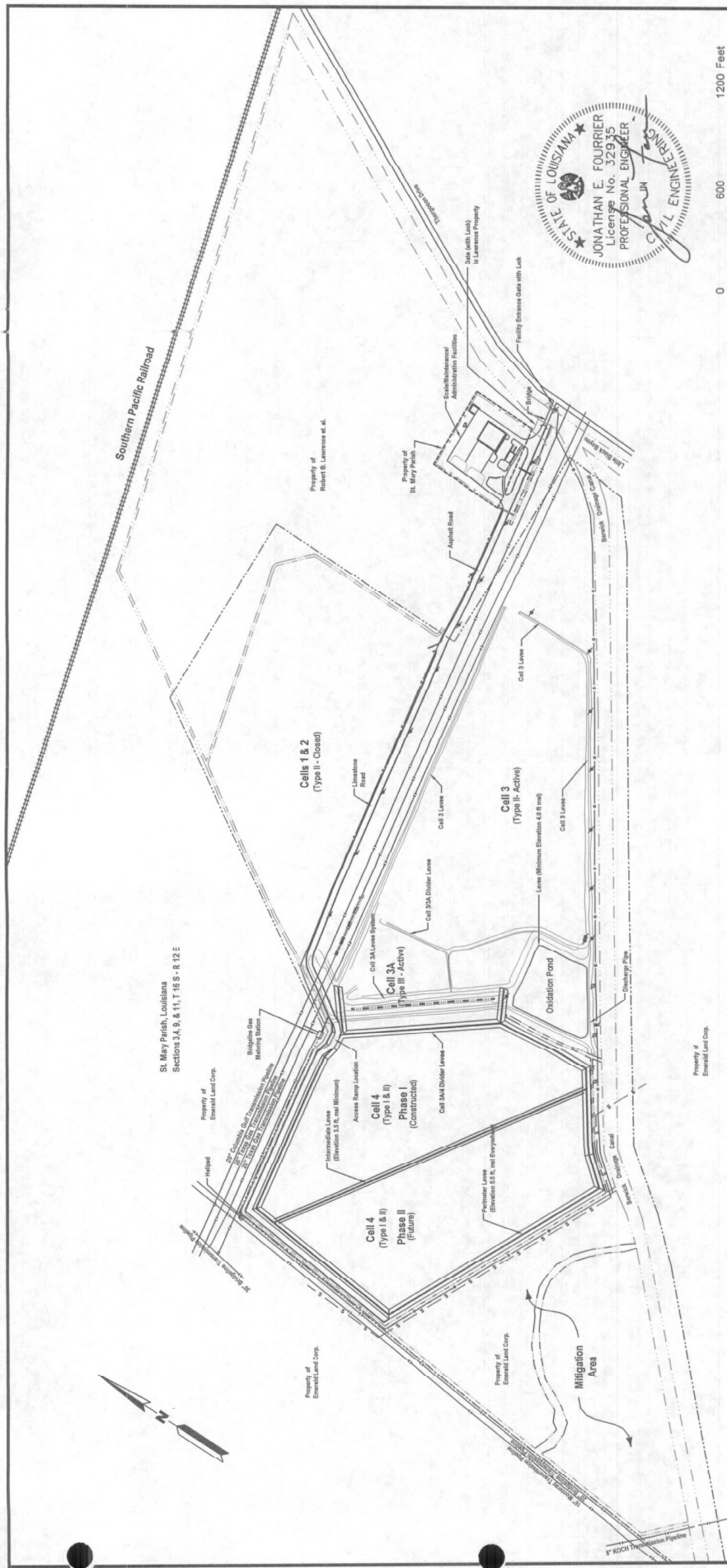
1. Fencing

A chain-link fence is located across the front of the facility and is posted with signs prohibiting trespass. The only vehicular access point to the site is through the front gate in the chain link fence at the facility entrance, which is continuously manned during operating hours and locked during non-operating hours. Perimeter ditches and canals, combined with the chain link fence across the front, restrict human trespass and prevent unauthorized vehicle access to the facility. The only vehicular entry point to the neighboring Lawrence property is through the front gate of the landfill. Refer to the Site Access Plan (Exhibit 5).

2. Signage

At the front gate is a sign that clearly states what types of waste are accepted at the facility, as well as a list of those wastes explicitly prohibited from disposal at the facility. In addition, a sign stating, "Asbestos Waste Disposal Site. Do Not Create Dust. Breathing Asbestos is Hazardous to Your Health." will be posted in accordance with LAC 33:III.5151.N.2 near the access ramp to Cell 4.

Exhibit 5
Site Access Plan



STATE OF LOUISIANA
JONATHAN E. FOURRIER
License No. 32935
PROFESSIONAL ENGINEER
CIVIL ENGINEERING

Exhibit 5
Site Access Plan
Hazardous Waste Landfill, Berwick, Louisiana
Solid Waste Standard Permit Modification Application No. 1-07

St. Mary Parish Government
Franklin, Louisiana

Date:	02/14/07	Checked By:	JEF	Job No.:	PEN-016
Drawn By:	WPL	Approved By:	WTT	Drawing No.:	PEN-016-E5

Legend

Existing Pipelines	Access Prevention Ditch or Canal
Property Boundary Lines (Leased)	Interior Ditch
Property Boundary Lines (Owned)	Levee
Sewer Force Main	Culvert
Chain Link Fence	Power Poles (Added)
Electric Fence (To be Installed if Required)	Power Poles

Note
The only vehicular access point to the Lawrence property is through the St. Mary Parish Landfill gate which is manned during operating hours and locked during non-operating hours.

Appendix H

Closure and Post-Closure Plan

4.4 CLOSURE COST ESTIMATES

Closure cost estimates are presented in Table 2. These estimates are based on current (2000) costs to close the solid waste units assuming that closure activities are performed by a third party and the units are at their maximum capacity. The cost estimates presented in Table 2 are for the closure of Cells 3, 3a, and 4, which total approximately 107 acres.

Financial assurance for closure and post-closure will be demonstrated by the Local Government Financial Test in accordance with the requirements of §727.A.2.j.

4.5 RACM WASTE

As a Type I/II/III facility, the St. Mary Parish Landfill is authorized to accept Regulated Asbestos-containing Material (RACM) waste, as defined under LAC 33:VII.5151, into Type I/II Cell 4 only. The facility's site plan will be used to locate the position of the waste within the site. The location, grid coordinates, depth (elevation), and quantity (cubic yards) where each load was disposed will be recorded in the waste receipt log and made a permanent part of the St. Mary Parish Landfill records.

LDEQ (Office of Environmental Services, Air Permits Division) will be notified in writing at least 45 days prior to excavating or otherwise disturbing any RACM waste that has been deposited within the landfill and covered. Notification will be provided in accordance with LAC 33:III.5151.N.10.

A copy of all records of RACM waste disposal locations and quantities will be submitted to LDEQ (Office of Environmental Services, Air Permits Division) upon closure of the facility. In addition, within 60 days of closure and in accordance with State law, a notation will be attached in perpetuity to the deed of the facility property and on any other instrument that would normally be examined during a title search stating that:

- a. The land has been used for disposal of RACM waste;
- b. The survey plot and record of the location and quantity of RACM waste disposed of at the facility; and
- c. The site is subject to LAC 33:III.Chapter 51.Subchapter M and the certification provisions in LAC 33:III.2799.Appendix A – Agent Accreditation Plan.